



**SWAMI RAMANAND TEERTH MARATHWADA UNIVERISTY,
NANDED**

**SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR
Under Graduate Programme
Faculty of Science and Technology**

SUBJECT : BOTANY

B.Sc. Third Year

With Effect from June 2018.



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (CBCS Pattern)

Introduction:

The University Grants Commission (UGC) has initiated several measures to bring equity, efficiency and excellence in the Higher Education System of country. The important measures taken to enhance academic standards and quality in higher education include innovation and improvements in the curriculum, teaching-learning process, examination and evaluation systems, besides governance and other matters.

As a result, the grading system is considered to be better than the conventional marks system and hence it has been followed by our university. So, it is desirable to introduce uniform Choice Based Credit System CBCS system. This will facilitate student mobility across institutions within and across countries and also enable potential employers to assess the performance of students.

The CBCS provides choice for students to select from the prescribed courses (core, elective or minor or soft skill courses). The choice based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our university has already introduced the choice based credit system. The semester system accelerates the teaching-learning process and enables vertical and horizontal mobility in learning.

Keeping in mind BoS in Botany prepared the curriculum to ensure up-to-date level of understanding of plant sciences. Studying plant sciences prepares the student for a career working in either an educational institution or an industry in which you can be directly involved in the research and development and Knowledge of modern and applied plant science and excellent career prospects.

The study of Botany aims to expand and increase current knowledge about plants in order to solve problems in many fields including agriculture, ecology, medicine, biotechnology and horticulture. These are some of the objectives kept in mind during drafting the syllabi.

How plants function at the cellular, tissue, organ, and organismal levels? How evolution of plants and how they contribute to biodiversity. How interactions with each other impact their physical environment are the core objectives.

The addition of Skill enhancement course aims to develop skills in plant sciences and practical experience to the students.

At the end of the curriculum, the student should have increased an aptitude towards science and nature, undertakes the fundamental and applied research in plant science for the benefit of the human and nature.

At last comments, suggestions are welcome from all the teachers, stakeholders and students for the upbringing the curriculum.

Salient Features :

The syllabus of B Sc IIIrd year Botany has been framed to meet the requirement of Choice based Credit System. The courses offered here in will train and orient the students in the field of Botany.

The Section A of DSEB deals with Plant Physiology, Plant Metabolism, Biochemistry and Biotechnology. The Section B of DSEB with choice provides an option to learn courses like Plant Pathology-I & II, Systematic Botany-I & II and Herbal Technology-I & II.

This would help students to lay a strong foundation in the field of Botany.

Overall after completion of this course, students will also acquire fundamental knowledge in Plant Science and also understand that Botany is an integral part of the human life and developments.

Skill Enhancement Courses like Fruits and vegetables processing, Herbal drug technology, Floriculture, Bioinstrumentation, Medicinal plant product preparation skill, Fungal biomass production skill (Mushroom cultivation), Fungal biomass production for biocontrol and Algal biomass production skill (*Spirulina* cultivation) offered during this program are designed with the aim of imparting specific skills to the students which will lead to the self employability through development of their own enterprises.

Utility of Course

This program will train and orient the students in the field of Genetics and Molecular Biology , Plant Breeding , Diversity of Plants, Anatomy and Embryology of Angiosperms, Environmental Biology, Plant Physiology, Biochemistry and Biotechnology, Plant Pathology, Systematic Botany and Herbal Technology in relation to Environment and Agriculture as well as Biotechnological, Pharmaceutical and Herbal Industries. This will help the students for their career development.

Skill Enhancement Courses offered during this program will provide additional specific skills to the students for self employability through the development of their own enterprises.

Learning Objectives :

The Objective of this program are :

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.

Prerequisite :

The optional courses are offered to the students registered for undergraduate programs. Such students should have the basic knowledge of Plant Science and willing to gain additional knowledge in the field of Botany.



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SUBJECT : BOTANY

Class : B.Sc. Third Year

An Outline:

Semester/ Annual	Course No		Name of the Course	Total Periods (Periods/ Week)	Marks for		Credits (Marks)
					External (ESE)	Internal (CA)	
Semester-V	DSEB-I	Section -A	Theory Paper- XII: Plant Physiology	45 (03/week)	40	10	Credits:02 (Marks: 50)
		Section -B	Theory Paper- XIII: B I: Plant Pathology-I OR B II: Systematic Botany-I OR B III: Herbal Technology-I	45 (03/week)	40	10	Credits:02 (Marks: 50)
Semester-VI	DSEB- II	Section -A	Theory Paper- XIV: Plant Metabolism, Biochemistry and Biotechnology	45 (03/week)	40	10	Credits:02 (Marks: 50)
		Section -B	Theory Paper- XV: B I: Plant Pathology-II OR B II:	45 (03/week)	40	10	Credits:02 (Marks: 50)

			Systematic Botany-II OR B III: Herbal Technology-II				
Annual Pattern	DSEBP-I (DSEB I & II Section A)	--	Practical Paper XVI: Practicals based on theory papers-XII & XIV	16 Pract. (03/week/ Batch)	40	10	Credits:02 (Marks: 50)
	SECB III	--	SEC- III A Or B	01 Skill (03/week/ Batch)	25	25	Credits:02* (Marks: 50)
Annual Pattern	DSEBP-II (DSEBI & II Section B)	--	Practical Paper XVII: Practicals based on theory papers-XIII & XV	16 Pract. (03/week/ Batch)	40	10	Credits:02 (Marks: 50)
	SECB IV	--	SEC- IV A OR B	01 Skill (03/week/ Batch)	25	25	Credits:02* (Marks: 50)
Total Credits Semester –V & VI					240+50 = 290	60+50 =110	Credits:12+4* = 16 (Marks: 300+100* = 400)

ESE : End Semester Examination, **CA** : Continues Assessment, **SECB**: Skill Enhancement Course Botany, **DSEB**: Discipline Specific Elective Botany, **DSEBP**: Discipline Specific Elective Botany Practical

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

CA of 10 Marks (Theory) : 05 Marks for test & 05 Marks for Assignment

CA of 10 Marks (Practicals): : 05 Marks for test & 05 Marks for Record Book ,Submission of collection and field note and Excursion Report.

CA of 25 Marks : 15 Marks for Seminar & 10 Marks for Test



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Semester pattern curriculum under
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BOTANY
B.Sc. T.Y.
Semester – V
DSEB-I
Theory Paper –XII : Plant Physiology
(Compulsory)

Periods – 45

Maximum Marks – 50

UNIT-I: PLANT WATER RELATIONS (11 periods)

Importance of water in plant life

Different bio-physico-chemical phenomenon: Permeability, Diffusion, Osmosis, Plasmolysis and Imbibition.

Ascent of sap: Introduction and mechanism (transpiration pull theory),

Transpiration: Definition, types, structure of stomata, mechanism of opening and closing of stomata (starch-sugar theory and K⁺ pump theory).

Plant movements: Introduction, classification, paratonic and nastic movements.

UNIT-II: MINERAL NUTRITION (11 periods)

Major and Minor elements: Introduction, source, deficiency symptoms and their role.

Mineral salt absorption: Introduction, mechanism of passive absorption (ion exchange theory) and active absorption (carrier concept theory)

Translocation of organic solutes: Introduction, mechanism of translocation (Munch-Mass flow hypothesis)

UNIT-III: GROWTH AND DEVELOPMENT (12 periods)

Growth and Plant growth regulators: Introduction, phases of growth, measurement of growth (arc indicator and Pfeiffer's auxanometer), factors affecting growth, Chemical nature and practical applications of Auxins, gibberellins, cytokinins, abscisic acid and ethylene.

Seed dormancy: Introduction, causes of seed dormancy and methods of breaking seed dormancy

Seed germination: Introduction, types and mechanism of seed germination,

Physiology of flowering: Introduction, Photoperiodism (LDP, SDP and DNP),

Vernalization and devernalization: Introduction, mechanism and significance,

UNIT-IV: BIOMOLECULES AND SECONDARY METABOLITES (11 periods)

Biomolecules:

Carbohydrates: introduction, structure and classification, Monosaccharides, disaccharides and polysaccharides (starch and cellulose)

Protein- Introduction, classification and biological functions of Primary, secondary (α helix and β sheets), tertiary and quaternary structure

Lipids: Introduction, structure classification and biological functions of lipids

Secondary metabolites: Biological functions of tannins, terpenoids, flavonoids, alkaloids, essential oils and organic acids

Theory paper-XII: Plant physiology (Compulsory)-Unit wise distribution of periods and marks

Unit	Title	Periods Allotted	Maximum Marks
I	Plant Water Relations	11	20
II	Mineral Nutrition	11	20
III	Growth and Development	12	20
IV	Biomolecules and Secondary Metabolites	11	20
Total		45	80



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BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – V
Theory Paper-XII

Time: TWO hours

Maximum Marks: 40

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

Q1. Attempt any Four of the following (Each of 02 Marks) 08

- a)
- b)
- c)
- d)
- e)
- f)

(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit

Q2. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit I, II)

Q3. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit I, II)

Q4. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit III, IV)

Q5. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit III, IV)



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**Semester pattern curriculum under
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BOTANY
B.Sc. T.Y.
Semester – V
DSEB-I
Theory Paper –XIII**

**SEMESTER-V (OPTIONAL-I)
PLANT PATHOLOGY-I (B-I)**

Periods – 45

Maximum Marks – 50

UNIT-I : FUNDAMENTALS OF PLANT PATHOLOGY (11 periods)

Scope, importance, history and advancement of plant pathology, classification of plant diseases on the basis of causal organism and symptoms, field and laboratory diagnosis- Isolation of plant pathogens from infected plant parts, soil and air, Pure culture technique, Koch's postulates for pathogenicity.

UNIT-II : PLANT DISEASE DEVELOPMENT (11 periods)

Disease development- Mode of entry of pathogens (through stomata, wounds, root hairs and buds), Factors affecting disease development- Temperature, moisture, wind and soil pH, Dispersal of plant pathogens (by air, water, insects and animals), chemical weapons of pathogen: enzymes, toxins and growth regulators..

UNIT-III : PLANT DISEASES-I (12 periods)

Symptoms, causal organisms, disease cycle and control measures of Green ear of Bajra, leaf spot of tomato, Grain smut of Jowar, Red rot of Sugarcane, Angular leaf spot of cotton, , Bacterial blight of Pomegranate, Anthracnose of mango

UNIT-IV : PLANT DISEASES-II (11 periods)

Symptoms, causal organisms, disease cycle and control measures of White rust of Mustard, Whip smut of Sugarcane, Powdery mildew of pea, Leaf spot of Turmeric (*Colletotrichum capsici*), Citrus canker, Sigatoka disease of Banana, leaf blight of Rice.

Theory paper-XIII: B-I - Plant pathology-I (Optional) – Unit wise distribution of periods and marks :

Unit	Title	Periods Allotted	Maximum Marks
I	Fundamentals of Plant Pathology	11	20
II	Plant Disease Development	11	20
III	Plant Diseases-I	12	20
IV	Plant Diseases-II	11	20
	Total	45	80



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BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – V, Plant Pathology-I (Optional-I)
Theory Paper-XIII

Time: TWO hours

Maximum Marks: 40

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

Q1. Attempt any Four of the following (Each of 02 Marks) 08

- a)
- b)
- c)
- d)
- e)
- f)

(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit

Q2. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit I, II)

Q3. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit I, II)

Q4. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit III, IV)

Q5. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit III, IV)



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BOTANY
B.Sc. T.Y.
Semester – V
DSEB-I
Theory Paper –XIII

SEMESTER-V (OPTIONAL-II)
SYSTEMATIC BOTANY-I (B-II)

Periods – 45

Maximum Marks – 50

UNIT –I: CLASSIFICATION (11 periods)

Introduction- Definition, aims, scope and application of angiosperms taxonomy, Types of classification- Artificial, Natural and Phylogenetic, Outline of Bentham and Hooker, Engler and Prantle and Hutchinson's systems of classification of angiosperms with merits and demerits

UNIT –II: PRINCIPLES OF TAXONOMY (11 periods)

ICN (International Code of Nomenclature)-Brief history, principle of priority, effective and valid publication, typification and author citation, Species concept- Morphological and biological, Role of phytochemistry, cytology, anatomy and palynology in relation to taxonomy. Pollen morphology with reference to pollen grains of *Hibiscus*, *Ipomoea* and Grasses

UNIT –III: TAXONOMIC TOOLS (11 periods)

Herbarium- Techniques of plant preservation, Importance of herbarium, Botanical gardens- Role in plant taxonomy, Important Botanical gardens, Plant identification, key-Types and use

UNIT –IV: STUDY OF DICOT FAMILIES-I (12 periods)

Study of following families according to Bentham and Hooker's system of classification with reference to general characters, pollination, floral formulae, floral diagrams, systematic position, distinguishing features and economic importance

Papaveraceae, Capparidaceae, Combretaceae, Myrtaceae, Rutaceae.

Theory paper-XIII: B-II - Systematic Botany-I (Optional-II) - Unit wise distribution of periods and marks:

Unit	Title	Periods Allotted	Maximum Marks
I	Classification	11	20
II	Principles of Taxonomy	11	20
III	Taxonomic Tools	11	20
IV	Study of Dicot Families-I	12	20
Total		45	80



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BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – V , Systematic Botany-I (Optional-II)
Theory Paper-XIII

Time: TWO hours

Maximum Marks: 40

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

-
- Q1. Attempt any Four of the following (Each of 02 Marks) 08
a)
b)
c)
d)
e)
f)
(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit
- Q2. Attempt any Two of the following (Each of 04 Marks) 08
a)
b)
c)
(Based On Unit I, II)
- Q3. Attempt any One of the following (Each of 08 Marks) 08
a)
b)
(Based On Unit I, II)
- Q4. Attempt any Two of the following (Each of 04 Marks) 08
a)
b)
c)
(Based On Unit III, IV)
- Q5. Attempt any One of the following (Each of 08 Marks) 08
a)
b)
(Based On Unit III, IV)



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**Semester pattern curriculum under
Choice Based Credit System (CBCS) for**

BOTANY

B.Sc. T.Y.

Semester – V

DSEB-I

Theory Paper –XIII

**SEMESTER-V (OPTIONAL-III)
HERBAL TECHNOLOGY-I (B-III)**

Periods – 45

Maximum Marks – 50

UNIT-I: MEDICINAL AND AROMATIC PLANTS (MAP) (11 periods)

Introduction, History, importance, demand and supply of MAP in India, Indian systems of medicine- Ayurvedic, Unani, homeopathic, siddha, yoga and naturopathy, tribal medicine sources, Herbal sources, Animal sources, Mineral sources, their collection, purification and processing.

UNIT-II: CRUDE PLANT DRUGS (11 periods)

Definition, Classification- Alphabetic, taxonomic, morphological, chemical, pharmacological and Chemotaxonomic, Methods of cultivation and factors affecting the cultivation of drug plants, Collection, harvesting, drying and storage of crude drugs, organized crude drugs- Leaves, stem, Flowers, fruits, seeds, barks, underground and entire plant drugs, Unorganized drugs- Gums, Mucilage, resins, dried juices, latex and extracts

UNIT-III: PHARMACOGNOTIC STUDIES (11 periods)

Distribution, morphology, anatomical, chemical constituents and uses of Root drugs- Shatavari, Ashwagandha, Stem drugs- Ginger, turmeric, Gulvel, Chandan, Leaf drugs- Adulsa, Korphad (*Aloe*), Fruit drugs- Behda, Hirda and Entire plant drugs- Tulsi and Aghada

UNIT-IV: MEDICINAL PLANT BIOTECHNOLOGY AND STANDARDIZATION OF DRUGS (12periods)

Genetics as applied to medicinal herbs and transgenic plants, Plant tissue culture as source of biomedicines, Importance of drug standardization, Problems of standardization of herbs, Drug adulteration, Methods of drug evaluation- Morphological, microscopic, chemical, physical and Biological. Tissue culture of medicinal important plants, secondary metabolites production (Alkaloids, Flavonoids)

Theory paper-XIII: B-III- Herbal technology-I (Optional-IV) - Unit wise distribution of periods and marks:

Unit	Title	Periods Allotted	Maximum Marks
I	Medicinal and Aromatic Plants (Map)	11	20
II	Crude Plant Drugs	11	20
III	pharmacognostic studies	11	20
IV	Medicinal Plant Biotechnology and Standardization of Drugs	12	20
Total		45	80



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BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – V , Herbal Technology-I (Optional-III)
Theory Paper-XIII

Time: TWO hours

Maximum Marks: 40

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

- Q1. Attempt any Four of the following (Each of 02 Marks) 08
a)
b)
c)
d)
e)
f)
(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit
- Q2. Attempt any Two of the following (Each of 04 Marks) 08
a)
b)
c)
(Based On Unit I, II)
- Q3. Attempt any One of the following (Each of 08 Marks) 08
a)
b)
(Based On Unit I, II)
- Q4. Attempt any Two of the following (Each of 04 Marks) 08
a)
b)
c)
(Based On Unit III, IV)
- Q5. Attempt any One of the following (Each of 08 Marks) 08
a)
b)
(Based On Unit III, IV)



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**Semester pattern curriculum under
Choice Based Credit System (CBCS) for**

BOTANY

B.Sc. T.Y.

Semester – VI

DSEB -II

**Theory Paper –XIV : Plant Metabolism,
Biochemistry and Biotechnology
(Compulsory)**

Periods – 45

Maximum Marks – 50

UNIT-I: PHOTOSYNTHESIS AND RESPIRATION (12 periods)

Photosynthesis: Introduction, significance, ultra structure of chloroplast, photosynthetic pigments, concepts of two Photo systems, Mechanism of photosynthesis, Light reaction, Hill reaction, Cyclic and Non cyclic photophosphorylation, Dark phase, Calvin cycle (C3) and Hatch and Slack (C4) pathway, CAM pathway

Respiration: Introduction, significance, ultra structure of mitochondria, structure and functions of ATP, **Types of respiration:**

Aerobic respiration- Glycolysis, Krebs' cycle, Electron Transport System.

Anaerobic respiration- Fermentation (alcoholic and lactic acid)

UNIT-II: : ENZYMES AND NITROGEN METABOLISM (11 periods)

Enzymes: Introduction, nomenclature and classification (IUB), mechanism of enzyme action (lock and key model, induced fit model), Concept of holoenzyme, mechanism of regulation of enzyme activity-Feedback and allosteric regulation.

Nitrogen metabolism: Introduction, sources and forms of nitrogen, types of nitrogen fixation-physical and biological (symbiotic and asymbiotic), Ammonification, nitrification and denitrification

UNIT -III: BIOTECHNOLOGY (11periods)

Tissue culture: Introduction and basic aspects of tissue culture, media, culture techniques, cellular totipotency.

Applications of tissue culture: Micropropagation, Production of disease free plants, production of secondary metabolites, Anther culture and production of haploids, protoplast culture and somatic hybridization, synthetic seeds

UNIT-IV: GENETIC ENGINEERING (11 periods)

Introduction, tools and techniques of recombinant DNA technology, Cloning vectors, Gene cloning, Genomic library and cDNA library, *Agrobacterium* mediated gene transfer, transgenic plants.

Bioinformatics: Introduction, Biological database, NCBI, BLAST.

Theory paper-XIV: Plant metabolism, biochemistry and biotechnology (Compulsory) -**Unit wise distribution of periods and marks:**

Unit	Title	Periods Allotted	Maximum Marks
I	Photosynthesis and Respiration	12	20
II	Enzymes and Nitrogen Metabolism	11	20
III	Biotechnology	11	20
IV	Genetic Engineering	11	20
Total		45	80



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BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – VI
Theory Paper-XIV

Time: TWO hours

Maximum Marks: 40

-
- Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary
-

-
- Q1. Attempt any Four of the following (Each of 02 Marks) 08
a)
b)
c)
d)
e)
f)
(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit
- Q2. Attempt any Two of the following (Each of 04 Marks) 08
a)
b)
c)
(Based On Unit I, II)
- Q3. Attempt any One of the following (Each of 08 Marks) 08
a)
b)
(Based On Unit I, II)
- Q4. Attempt any Two of the following (Each of 04 Marks) 08
a)
b)
c)
(Based On Unit III, IV)
- Q5. Attempt any One of the following (Each of 08 Marks) 08
a)
b)
(Based On Unit III, IV)



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BOTANY

B.Sc. T.Y.

Semester – VI

DSEB -II

Theory Paper –XV

SEMESTER-VI (OPTIONAL-I)

PLANT PATHOLOGY-II (B-I)

Periods – 45

Maximum Marks – 50

UNIT-I : AEROBIOLOGY AND SEED PATHOLOGY (11 periods)

Aerobiology- Definition, scope and importance and disease forecasting, Seed pathology- Definition, seed borne pathogens (external and internal) detection of seed borne pathogens by blotter paper and agar plate methods, seed treatment (hot water, solar, chemical) and seed certification.

UNIT-II : DEFENSE MECHANISM AND PLANT DISEASE MANAGEMENT (11 periods)

Structural (pre-existing and Post infectious) and biochemical defense-pre-existing and Post infectious (phytoalexins) Exclusion and eradication, Chemical control- General account of Sulphur, Copper, systemic fungicides and antibiotics, Integrated pest management.

UNIT-III : PLANT DISEASES-I (11 periods)

Symptoms, causal organisms, disease cycle and control measures of Tikka disease of groundnut, Ergot of Bajra, Loose smut of Wheat, Rust of Jowar, Phanerogamic parasites(Cuscuta), Leaf curl of tomato.

UNIT-IV : PLANT DISEASES-II (12 periods)

Symptoms, causal organisms, disease cycle and control measures of Downy mildew of Grape, Stem rust of Wheat, Wilt of Tur, late blight of Potato, Grassy shoot of Sugarcane, Papaya mosaic, Rust of Soybean, Leaf spot of cabbage.

Theory paper-XIII: B-I- Plant pathology-II (Optional-I) – Unit wise distribution of periods and marks :

Unit	Title	Periods Allotted	Maximum Marks
I	Aerobiology and Seed Pathology	11	20
II	Defense Mechanism and Plant Disease Management	11	20
III	Plant Diseases-I	11	20
IV	Plant Diseases-II	12	20
	Total	45	80



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Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – VI, Plant Pathology-II (Optional-I)
Theory Paper-XV

Time: TWO hours

Maximum Marks: 40

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- Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary
-

Q1. Attempt any Four of the following (Each of 02 Marks) 08

- a)
- b)
- c)
- d)
- e)
- f)

(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit

Q2. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit I, II)

Q3. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit I, II)

Q4. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit III, IV)

Q5. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit III, IV)



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**Semester pattern curriculum under
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BOTANY
B.Sc. T.Y.
Semester – VI
DSEB- II
Theory Paper –XV**

**SEMESTER-VI (OPTIONAL-II)
SYSTEMATIC BOTANY-II (B-II)**

Periods – 45

Maximum Marks – 50

UNIT –I: STUDY OF DICOT FAMILIES-II (11 periods)

Study of following families according to Bentham and Hooker's system of classification with reference to general characters, pollination, floral formulae, floral diagrams, systematic position, distinguishing features and economic importance

Mimosaceae, Cucurbitaceae, Rubiaceae, Apocynaceae, Convolvulaceae

UNIT –II: STUDY OF DICOT FAMILIES-III (11 periods)

Study of following families according to Bentham and Hooker's system of classification with reference to general characters, pollination, floral formulae, floral diagrams, systematic position, distinguishing features and economic importance

Bignoniaceae, Acanthaceae, Verbenaceae, Nyctaginaceae, Amaranthaceae,

UNIT –III: STUDY OF MONOCOT FAMILIES (12 periods)

Study of following families according to Bentham and Hooker's system of classification with reference to general characters, pollination, floral formulae, floral diagrams, systematic position, distinguishing features and economic importance

Orchidaceae, Musaceae, Zingiberaceae, Cannaceae, Commelinaceae, Cyperaceae

UNIT –IV: ORIGIN OF ANGIOSPERMS (11 periods)

Place and Time of origin of angiosperms, Probable ancestors of Angiosperms: Bennettitalean theory, Gnetalean theory, Pteridosperm theory

Theory paper-XV: B-II-Systematic Botany-II (Optional-II) - Unit wise distribution of periods and marks:

Unit	Title	Periods Allotted	Maximum Marks
I	Study of Dicot Families -II	11	20
II	Study of Dicot Families -III	11	20
III	Study of Monocot Families	12	20
IV	Origin of Angiosperms	11	20
Total		45	80



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – VI ,Systematic Botany- II
Theory Paper-XV Optional -II

Time: TWO hours

Maximum Marks: 40

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

Q1. Attempt any Four of the following (Each of 02 Marks) 08

- a)
- b)
- c)
- d)
- e)
- f)

(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit

Q2. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit I, II)

Q3. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit I, II)

Q4. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit III, IV)

Q5. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit III, IV)



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Semester pattern curriculum under
Choice Based Credit System (CBCS) for
BOTANY
B.Sc. T.Y.
Semester – VI
DSEB -II
Theory Paper –XV

SEMESTER-VI (OPTIONAL-III)
HERBAL TECHNOLOGY-II (B-III)

Periods – 45

Maximum Marks – 50

UNIT-I: HERBAL FORMULATION (11periods)

Steps of herbal formulation- Grinding, extraction, filtration, concentration, Dosage forms- Infusion, decoction, tincture, capsule, medicated wines, syrups, tablets, ointment and creams, Comparative study of- Ayurvedic and modern dosage forms. Preparation and therapeutic uses of Triphalachurna, Kumariasav, Arjunarishtha (Aristha), Gooti, Vatti and Telam

UNIT-II: DRUG CONSTITUENTS AND BIOSYNTHETIC PATHWAY. (11periods)

Introduction, occurrence and chemistry and Biosynthetic pathway of glycosides, alkaloids and steroids Flavonoids. Alkaloid: Reserpine, Morphin. Glycosides: Glycyrrhizin, Digitoxin. Steroids: Withanoloids. Flavonoids: Quercetin, Ritin. Carotenoids: Lycopene-carotene.

UNIT-III: ANALYTICAL AND CHROMATOGRAPHIC TECHNIQUES. (11 periods)

Principles and applications of spectral techniques in drug analysis: Colorimeter, UV-visible spectrophotometer, IR and NMR spectroscopy, paper chromatography, TLC, HPTLC, column and GC chromatography.

UNIT-IV: HERBAL COSMETICS (12 periods)

Classification of cosmetics, brief account of raw material used for cosmetic preparation, stability testing of herbal cosmetics, quality control and packaging of cosmetics. Study and preparation of skin care product (moisturizing creams and anti-ageing cream, hair care product (Hair oil, shampoos)

Theory paper-XV: B-III- Herbal technology-II (Optional-IV) - Unit wise distribution of periods and marks:

Unit	Title	Periods Allotted	Maximum Marks
I	Herbal Formulation	11	20
II	Drug Constituents and Biosynthetic pathways	11	20
III	Analytical Chromatographic Techniques	11	20
IV	Herbal cosmetics	12	20
Total		45	80



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS)

Skeleton Question Paper
B. Sc. Third Year
Semester – VI, Herbal Technology-II (Optional-III)
Theory Paper-XV

Time: TWO hours

Maximum Marks: 40

Note: - (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

Q1. Attempt any Four of the following (Each of 02 Marks) 08

- a)
- b)
- c)
- d)
- e)
- f)

(Based On Unit I, II, III, IV) Minimum one and maximum two from each Unit

Q2. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit I, II)

Q3. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit I, II)

Q4. Attempt any Two of the following (Each of 04 Marks) 08

- a)
- b)
- c)

(Based On Unit III, IV)

Q5. Attempt any One of the following (Each of 08 Marks) 08

- a)
- b)

(Based On Unit III, IV)



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

BOTANY – CURRICULUM

B.Sc. General (Semester Pattern)

Choice Based Credit System (CBCS) Pattern

B. Sc. THIRD YEAR

Annual Pattern

PRACTICAL PAPER-XVI: BASED ON THEORY PAPERS-XII & XIV

(Compulsory)

Practicals

Maximum Marks – 50

Practical Exercises:

1. To determine the water potential of potato tuber
2. To determine the osmotic potential of vacuolar sap by plasmolysis
3. To study the effect of temperature on permeability of plasma membrane (Beet root) by using colorimeter / spectrophotometer
4. To study the effect of concentration of different organic solvents on permeability of plasma membrane (Beet root) by using colorimeter/spectrophotometer
5. To study the effect of different organic solvents on permeability of plasma membrane (Beet root) by using colorimeter/ spectrophotometer
6. Separation of photosynthetic pigments by paper chromatography
7. To study the effect of light colour on rate of photosynthesis
8. Determination of RF value and identification of amino acids in a mixture
9. Preparation of standard graph of starch using Colorimeter/ Spectrophotometer and determination of starch content of the given plant material
10. Preparation of standard graph of glucose using Colorimeter/ Spectrophotometer and determination of glucose content of the given plant material
11. Preparation of standard graph of protein using Colorimeter/ Spectrophotometer and determination of protein content from given plant material
12. To estimate the percentage of oil content in given oil seeds using Soxhlet extractor.
13. Study of catalase activity under different pH
14. Study of catalase activity under different temperature
15. Demonstration of osmosis by potato osmoscope
16. To study the mineral deficiency symptoms in at least four locally available plants
17. Demonstrations of the Arc indicator (lever auxanometer), Clinostat (Geotropism), Kuhn's fermentation tube experiment (Requirements, procedure and workings of the same are expected)
18. Study of tools used in GE/ Tissue culture laboratory for sterilization and inoculation. Principle and working of Autoclave, oven, incubator, Laminar Air flow, Inoculating chamber, callus culture, plantlet, Anther culture and protoplast culture
19. Study major biological databases
20. Study of gene sequence in FASTA Format
21. Qualitative analysis of proteins (Biuret/ Xanthoproteic/ Millon tests)
22. Qualitative analysis of Carbohydrates (Molisch /Fehlings /Benedict's) Glucose, sucrose, starch, Cellulose and Pectin
23. Qualitative test of tannin, terpenoids, saponins, flavonoids and alkaloids
24. Micro chemical test for organic acids – Tartaric acid, Citric acid, Oxalic and Malic acid
25. Botanical Excursions (Two short excursions and one long excursion and visits to laboratories / companies/ factory etc.)

Note: Minimum of 16 practicals need to be conducted as per the question paper format



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (CBCS Pattern)

Skeleton Question Paper
B. Sc. THIRD YEAR BOTANY
DSEBP-I Annual Pattern
PRACTICAL PAPER-XVI: BASED ON THEORY PAPER-XII & XIV
(Compulsory)

Time: Four hours

Maximum Marks: 40

-
- Note: -
- (i) Attempt all questions
 - (ii) Show your preparation to the examiner
 - (iii) Draw neat and well labeled diagrams wherever necessary
-

- Q1. Perform any one experiment (From practical exercise 1 to 5) /
Perform any one experiment (From practical exercise 6 to 13) (12 marks)
- Q2. Describe procedure and working of any one experiment (From practical exercise 14 to 17)
(10 marks)
- Q3. Perform any four micro-chemical tests (Protein-1, carbohydrates-1, Secondary metabolites-1,
Organic acids-1) (10 marks)
- Q4. Spotting- Four spots (Instrument- 1, Callus/ Anther/ Protoplast culture- each 1) (04 marks)
- Q5. Viva –Voce (04 marks)



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)

Choice Based Credit System (CBCS) Pattern

B. Sc. THIRD YEAR

Annual Pattern

PRACTICAL PAPER-XVII: BASED ON THEORY PAPERS-XIII & XV

PLANT PATHOLOGY –I & II (Optional –I)

Practicals

Maximum Marks – 50

Practical Exercises:

1. Study of laboratory equipment's- Autoclave, Hot air oven, inoculating chamber, laminar air flow, Air sampler, Incubator, Centrifuge (1 practical)
2. Preparation of culture media – PDA, NA (1 Practical)
3. Micrometry- Calibration of microscope and measurement of fungal spores (1 practical)
4. Isolation of fungal pathogens from diseased plant parts, Toxins & Enzymes (1 practical)
5. Isolation and identification of seed-borne pathogen by blotter / agar plate method (1 Practical)
6. Study of air – borne pathogen by exposed petri plates / air sampler (2 Practical)
7. Proving of pathogenicity (1 Practical)
8. Effect of pH on growth of pathogens (1 Practical)
9. Effect of Temperature on growth of pathogens (1 Practical)
10. Effect of fungicide on spore germination by hanging drop technique (2 Practical)
11. Study of symptoms and causal organisms of Stem rust of wheat (1 Practical)
12. Study of symptoms and causal organisms of Late blight of potato and Downy mildew of grapes (1 Practical)
13. Study of symptoms and causal organisms of Tikka disease of groundnut & Anthracnose of guava (1 Practical)
14. study of symptoms and causal organisms of Leaf spot of tomato and leaf spot of turmeric (1 Practical)
15. Study of symptoms and causal organisms of Rust of Jowar and Grain smut of Jowar (1 practical)
16. Study of symptoms and causal organisms of Loose smut of Wheat, & leaf blight of rice (1 Practical)
17. Study of symptoms and causal organisms of Green ear and ergot of Bajra (1 Practical)

18. Study of symptoms and causal organisms of wilt of Tur and Whip smut of sugarcane
(1 Practical)
19. Study of symptoms and causal organisms of white rust of Mustard / leaf spot of cabbage
(1 Practical)
20. Study of symptomology of the following diseases-citrus canker, Root knot of tomato, Angular leaf spot of cotton, papaya mosaic , Rust of soybean , sigatoka disease of Banana , Anthracnose of mango , phanerogamic disease due to cuscuta
(3 practicals)
- 21.** Botanical excursions – Several local at least lone long excursion

Note: Minimum of 16 practicals need to be conducted as per the question paper format



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (CBCS Pattern)

Skeleton Question Paper
B. Sc. THIRD YEAR BOTANY
DSEBP-II-Annual Pattern

PRACTICAL PAPER-XVII: BASED ON THEORY PAPERS-XIII & XV
PLANT PATHOLOGY –I & II (Optional –I)

Time: Four hours

Maximum Marks: 40

-
- Note: -
- (i) Attempt all questions
 - (ii) Show your preparation to the examiner
 - (iii) Draw neat and well labeled diagrams wherever necessary
-

- Q.1 Calibrate the microscope and measure the size of given spores (10)
- Q.2 Identify and describe the symptoms and morphology of causal organism from the given specimen –B (12)
- Q.3 Identify and describe the symptoms of diseased specimen – C&D (10)
- Q.4 Identify and describe the given spots – E,F,G & H (E- Equipment, F- Diseased plant material , G- Toxins / Enzymes, H- Plant protectant (04)
- Q5. Viva –Voce (04)



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)

Choice Based Credit System (CBCS) Pattern
B. Sc. THIRD YEAR
Annual Pattern

PRACTICAL PAPER-XVII: BASED ON THEORY PAPERS-XIII & XV
SYSTEMATIC BOTANY –I & II (Optional –II)

Practical :

Maximum Marks – 50

Practical Exercises:

1. Description, identification and classification with sketches, floral formulae and floral diagrams of locally available plants of the following families -
Papaveraceae, Capparidaceae, Combretaceae, Myrtaceae, Rutaceae, Cucubitaceae, Rubiaceae, Apocynaceae, Convolvulaceae, Verbenaceae, Nyctaginaceae, Musaceae, Cannaceae, Commelinaceae **(15 practical)**
2. Preparation of dichotomous key by studying locally available plants of the same family **(1practical)**
3. Identification of at least six locally available plants up to species level with the help of flora (sketches, floral formulae and floral diagrams are not expected) **(2 practical)**
4. Study of pollen morphology by temporary preparation of pollen grains of Hibiscus, Datura, Ipomoea and Grasses by using acetolysis method **(2 practical)**
5. Botanical excursions

Note 1: Student must attend at least one long and two short botanical excursions.

Note 2: Minimum of 16 practicals need to be conducted as per the question paper format



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

BOTANY – CURRICULUM

B.Sc. General (CBCS Pattern)

Skeleton Question Paper

B. Sc. THIRD YEAR BOTANY

DSEBP-II, Annual Pattern

PRACTICAL PAPER-XVII: BASED ON THEORY PAPERS-XIII & XV

SYSTEMATIC BOTANY-I & II (Optional -II)

Time: 04 hours

Maximum Marks: 40

-
- Note: -
- (i) Attempt all questions
 - (ii) Show your preparation to the examiner
 - (iii) Draw neat and well labeled diagrams wherever necessary
-

- Q1.** Describe, identify and classify the given specimen-**A & B** to its respective families
With floral formulae and floral diagrams (16 Marks)
- Q2.** Identify the given specimen-**C** up to species level using key and flora (08 Marks)
- Q3.** Make a temporary preparation of pollen grain of the given specimen-**D** identify and
Describe (08 Marks)
- Q4.** Identify and describe the spots-**E, F, G** and **H** as per the given instructions
(2 spots on morphology; 2 spots on economic importance) (04 Marks)
- Q5.** Viva –Voce (04 marks)



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

BOTANY – CURRICULUM

B.Sc. General (Semester Pattern)

Choice Based Credit System (CBCS) Pattern

B. Sc. THIRD YEAR

Annual Pattern

**PRACTICAL PAPER-XVII: BASED ON THEORY PAPERS-XIII & XV
HERBAL TECHNOLOGY –I & II (Optional –III)**

Practicals:

Maximum Marks – 50

Practical Exercises:

1. Study of composition, preparation and uses of Ayurvedic medicine.
(Triphala, Decotion, Syrup) (3 practicals)
2. Macroscopic and microscopic evaluation of medicinal plants used as –Root drug, Stem drug, Leaf drug, (mentioned in theory) (5 practicals)
3. Study of leaf constant (stomatal number, stomatal index and palisade ratio) (2 practicals)
4. Preliminary phytochemical screening of alkaloids flavonoids, steroids, glycosides, carotenoids (mentioned in syllabus) (2 practicals)
5. Isolation and extraction of crude drug by using soxhlet / reflex assembly.(2 practicals)
6. Separation of alkaloids / flavonoids/ steroid / carotenoids / glycosids drug using paper / TLC / HPTLC.(2 practicals)
7. Quantitative estimation of secondary metabolites (mentioned in theory) (2 practicals)
8. Preparation of herbal formulation (antiseptic creams/hair oils / skin moisturizer / facial creams / shampoo) (2 practicals)
9. Excursion (3-Short and one long excursion are compulsory to visit pharmaceutical industry, field tour, research laboratories)

Note : Minimum of 16 practicals need to be conducted as per the question paper format



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (CBCS Pattern)

Skeleton Question Paper
B. Sc. THIRD YEAR BOTANY
DSEBP-II, Annual Pattern
PRACTICAL PAPER-XVII: BASED ON THEORY PAPERS-XIII & XV
HERBAL TECHNOLOGY –I & II (Optional –III)

Time: 04 hours

Maximum Marks: 40

-
- Note: - (i) Attempt all questions
(ii) Show your preparation to the examiner
(iii) Draw neat and well labeled diagrams wherever necessary
-

Q No 1. Macroscopic and microscopic evaluation of root/ stem / leaf drug. 10 M

OR

Preparation and study of herbal formulation: hair oil / skin moisturizers / antiseptic creams / triphalachurna / decoction/ syrup

Q. No. 2. Study of leaf constant (stomatal number, index, palisade ratio) 10 M

OR

Isolation and extraction of crude drug by suitable methods.

Q. No. 3. Preliminary phytochemical test or screening of any two drugs. 10 M

OR

Separation of alkaloids/ flavonoids/ steroids/ carotenoids/ glycosides using paper / TLC / HPTLC methods.

Q. No. 4. Spotting(6 spots) 06 M

- 01 Root drug.
- 02 Stem drug.
- 03 Leaf drug.
- 04 & 05 Herbal formulations.
- 06 Instrument(identification and working)

Q5. Viva –Voce 04 M



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

**SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR**

Under Graduate (UG) Programme

Faculty of Science and Technology

SUBJECT: BOTANY CLASS: B.Sc. THIRD YEAR

ANNUAL PATTERN

SECB (SKILL ENHANCEMENT COURSE BOTANY)

SECB-III (A)

Periods:45

Credits : 02 (Marks-50)

SECB –III (A) – FLORICULTURE

Unit-I) Fundamentals of Floriculture : Branches of floriculture, Present situation & scope.
Study of floricultural tools used in maintenance and in propagation.

Unit-II) Propagation by runners, suckers, off shoots & other vegetative means. Study of cut flowers, pot plants, seeds and bulbs, essential oil.

Unit-III) Soils and other media, manures and fertilizers, Irrigation. micro irrigation techniques like drip, sprinkler, fogger, fumigation, etc.

Unit-IV) Methods of propagation. Time of Propagation. Handling of seeds, bulbs, cut, flowers, nursery plants, pot plants. Control of diseases, insects and weeds.

Practicals:

- 1) Method of identifying major types of flowering plants (Trees, Shrubs, Climbers, Cacti, Succulents, House plants etc.), Pruning and shaping of the plants.
- 2) Cultural practices like planting time and distances and methods of planting, nutrition, irrigation & plant protection.
- 3) Making of floriculture.
- 4) Visit to flowering plants field.

Reference Books :

1. Floriculture in India-Gurucharan Singh Randhawa.
2. Advances in Floriculture-Suresh Malhotra.
3. Floriculture- APEDA

Note : Minimum of 5 practicals need to be conducted.



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

**SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR**

Under Graduate (UG) Programme

Faculty of Science and Technology

SUBJECT: BOTANY CLASS: B.Sc. THIRD YEAR

ANNUAL PATTERN

SECB (SKILL ENHANCEMENT COURSE BOTANY)

SECB-III (B)

Periods:45

Credits : 02 (Marks-50)

SECB –IIIB – BIOINSTRUMENTATION

Unit I Chromatography and Centrifugation: General principles of separation, paper chromatography, thin layer, affinity, gel permeation, ion exchange, GLC, HPTLC, preparative and analytical centrifugations and their application

Unit II Electrophoresis and Spectroscopy: Basic principles of electrophoresis, Factor affecting electrophoretic mobility, native and denaturing PAGE, isoelectric focusing, 2DE, Pulse field gel electrophoresis. Spectroscopy: Theory and applications of Ultra violet and visible spectroscopy, IR, Nuclear magnetic resonance, Mass and applications.

Practicals

1. Centrifugation
 - a. Isolation of cell organelles like cell membrane, mitochondria, ribosomes etc.
 - b. Determination of molecular weight of protein by centrifugation
2. Chromatography
 - a. Separation of amino acids by paper chromatography
 - b. Separation of sugars by TLC
 - c. Separation of plant pigments by paper/ TLC
 - d. Purification of proteins by Column / ion exchange / Molecular sieve chromatography
3. Electrophoresis
 - a. Separation of soy bean proteins by PAGE

4. Spectroscopy
 - a. Validation of Lambert-Beer's law (Photometer)
 - b. Estimation of DNA by DPA method (UV spectrophotometer)
 - c. Estimation of reducing sugars by DNSA method (VIS-Spectro.)

Note : Minimum of 5 practicals need to be conducted.

Reference Books :

1. Practical Biochemistry Paperback – 2016

by Damodaran Geetha K

2. An Introduction to Practical Biochemistry Paperback – 1 Jul 2017

by David Plummer

3. Practical Biochemistry Paperback – Import, 31 Jan 2013

by R. C. Gupta

4. Practical Biochemistry: A Student Companion Paperback – Import, 10 Jul 2015

by Tiwari Anand

5. Laboratory Manual For Practical Biochemistry Paperback – 2013

by Shivaraja Shankara Ym

6. A Text Book of Practical Biochemistry: 1 Paperback – Large Print, 1 Apr 2006

by Rashmi A. Joshi, Manju Saraswat



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

**SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR**

Under Graduate (UG) Programme

Faculty of Science and Technology

SUBJECT: BOTANY CLASS: B.Sc. THIRD YEAR

ANNUAL PATTERN

SECB (SKILL ENHANCEMENT COURSE BOTANY)

SECB-IV (A)

Periods:45

Credits : 02 (Marks-50)

SECB –IVA – FRUITS AND VEGETABLES PROCESSING

Unit I

Production and processing scenario of fruits and vegetables in India and World, Scope of fruit and vegetable preservation industry in India. present status, constraints and prospects, Overview of principles and preservation methods of fruits and vegetables (Physical and Chemical), Commercial processing technology of fruits and vegetables, Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables, Minimal processing of fruits and vegetables Blanching operations and equipment.

Unit II

Preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc; Problems on squash and RTS; Processing and equipment for above products and FSSAI specification Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and candies, Preparation, preservation and machines for manufacture of preserve, concentrate, fruit wine, pickles, sauce, paste, ketchup; toffee, cheese, lather, soup powders; FSSAI specification, Commercial processing technology of selected fruits and vegetables for production of various value added processed products.

Practicals :

1. Preparation of jam/ jelly from selected fruit
2. Preparation of RTS beverage e.g. Amala, Mango and Pineapple etc
3. Preparation of squash
4. Preparation of fruit candy
5. Preparation of fruit leather
6. Preparation of fruit toffee
7. Preparation of pickle
8. Preparation of banana and potato wafers
9. Visit to fruits and vegetables processing unit

Note : Minimum of 5 practicals need to be conducted.

Text Books:

Name of Book	Author	Publisher
1. Fruit and Vegetable Preservation Principles and Practices	Srivastava R.P. and Sanjeev Kumar	International Book Distributing Company, New Delhi 2005
2. Post Harvest Technology of Fruits and Vegetables : Handling, Processing, Fermentation and Waste Management vol. I & II	Varma L. R. and Joshi V.K.	Indus Publishing, 2000
3. Preservation of Fruits and Vegetables	Khader	ICAR, New Delhi 2010
4. Preservation of Fruits and Vegetable	G. Lal, G.S. Siddappa, G.L. Tandan	ICAR Publication, New Delhi 1996

Reference Books:

5. Name of Book	Author	Publisher
6. Fruit and Vegetable Processing	M.G. Danthy	FAO, Rome
7. Post harvest Handling and Processing of Fruit and Vegetable	I.S. Singh	Text book
8. Fruit Processing	David Arthey,	Reference book
9. Handbook of Fruit and	Sinha and Hui	John Wiley and

- Vegetable Processing
10. Fruit and Vegetable Preservation -Principles and Practices Srivastava RP & Kumar S Sons, 2010 International Book Distributors, 2003
11. Handbook of Fruit Science &Technology: Production, Composition and Processing. Salunkhe DK & Kadam SS. Marcel Dekker 1995



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

**SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR**

Under Graduate (UG) Programme

Faculty of Science and Technology

SUBJECT: BOTANY CLASS: B.Sc. THIRD YEAR

ANNUAL PATTERN

SECB (SKILL ENHANCEMENT COURSE BOTANY)

SECB-IV (B)

Periods:45

Credits : 02 (Marks-50)

SECB –IVB – HERBAL DRUG TECHNOLOGY

Unit- I

- 1.0 Introduction:
- 1.1 Role of natural products in herbal medicine
- 1.2 General status and importance of herbal medicine
- 1.3 Safety of herbals / herbal pharmacovigilance
- 1.4 WHO policy on herbal medicine
- 2.0 Herbs as raw materials:
 - 2.1 Definition of herb , herbal medicine, herbal medicinal product, herbal drug preparation
 - 2.2 Source of Herbs
 - 2.3 Selection, identification and authentication of herbal materials drying and processing of herbal raw material

Unit -II

3.0 Extraction of Herbal Materials

3.1 Choice of solvent for extraction

3.2 Methods used for extraction and principles involved in extraction

4.0 Standardization of herbal formulations & herbal extracts

4.1 Standardization of herbal extracts as per WHO and cGMP guidelines

4.2 Physical, chemical, Spectral and toxicological standardization, qualitative and quantitative estimations exemplified by the method of preparation of at least two standardized extracts

4.3 Stability studies for extract

4.4 Predictable chemical and galenical changes

Practicals:

1. Qualitative and Quantitative Microscopic Examination: Microscopic evaluation of powder drugs and their mixtures with adulterants
2. Exercises based on standardization and quality control of plant drugs
3. Qualitative and Quantitative Estimation of Phytoconstituents
4. Determination of phytoconstituents in crude drugs and commercial herbal formulations
5. Pharmacopoeial evaluation of natural products
6. Determination of ash values, extractive values, Swelling index and foaming index of crude drugs as per WHO Guidelines
7. Preparation of detailed monograph of at least one plant drug covering Pharmacognosy and Phytochemical investigation with its use in traditional system of medicine
8. Experiment on raw material standardization, purification of extracts with chromatographic techniques
9. Isolation of piperine from pepper
10. Isolation of Hesperidine from orange peel
11. Isolation & TLC of reserpine from Rauwolfia root
12. Isolation & TLC of Menthol from Mentha oil
13. Preparation and Evaluation of Herbal formulations

Note : Minimum of 5 practicals need to be conducted.



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS) FOR
Under Graduate (UG) Programme
Faculty of Science and Technology
SUBJECT: BOTANY
CLASS: B.Sc. THIRD YEAR
ANNUAL PATTERN
SECB (SKILL ENHANCEMENT COURSE BOTANY)
SECB-III &IV
END OF SEMESTER EXAMINATION (ESE)

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 judgment	10	
3	Skill Work presentation	05	
Total		25	

Name & Signature of:

Examiner- 1:

Examiner- 2:



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
BOTANY – CURRICULUM
B.Sc. General (Semester Pattern)

Selected Readings for Semester-V & VI:

- A text book of systematic botany – R.N.Sutaria
- A textbook of plant physiology and Biochemistry – Verma S.K.
- Aerobiology – S.T.Tilak
- Anb introduction to taxonomy of angiosperms – N.C.Kumar
- Angiosperms – G.L.Chopra
- College botany – Das, Datta & Ganguly
- College Botany- Sunder Rajan S
- College botany Vol-III – B.P.Pandey
- Diseases of crop plants in India – G.Rangaswami
- Diseases of crop plants in India – G.Rangaswami & Mahadevan
- Economic Botany – Hill A.F.
- Economic botany – S.N.Pandey & A. Chanda
- Economic botany – Sharma & Avasthi
- Elements of plant physiology – Sarabhai B.P.
- Essentiales of plant pathology – V.N.Pathak
- Experiments in plant physiology – Bajraracharya D.
- Experments in microbiology, plant pathology, tissue culture & mushroom cultivation – K.R.Aneja
- Flora of Kolhapur – S.R.Yadav & Sardesai
- Flora of Maharashtra – Almeda
- Flora of Marathwada – Chief Ed. By Dr. V.N. Naik
- Flora of Osmanabad – V. N. Naik.
- Flora of Tirupati – Madhed Chetty
- Flowering plants – Origin and dispersal – A.L. Takhtajan
- Fungi and plant diseases – B.B.Mundkur
- Fungicides in plant diseases control – Y.L.Nene
- Illustrated genera of fungi imperfectii – Barnett
- Illustrated kingdom of fungi – D.S.Mukadam
- Introduction to Principles of Plant Pathology – R.S.Singh
- Plant Dieases – R.S.Singh
- Plant Pathaology – B.P.Pandey
- Plant Pathaology – G.N.Agrios
- Plant Pathaology – R.S.Mehrotra
- Plant physiology – Dubey B.P.
- Plant physiology – Shrivastava H.S.
- Plant physiology, a laboratory guide – Wadje S.S. & MMV Baig
- Plant protection – Chattopadhyay
- Pollen morphology of angiosperms – N.P.K.Nair
- Seed pathology – D. Suryanarayana
- Seed pathology – D.K.Jha
- Seed pathology- Paul Neergaard
- Takhtajan A.L. (1997) Diversity and classification of flowering plant – Colubia University, press New York.
- Taxonomy of angiosperms – B.P.Pandey
- Taxonomy of angiosperms – P.C.Vasistha
- Taxonomy of angiosperms – Singh V. & D.K.Jain

- Taxonomy of angiosperms – V.N.Naik
 - Taxonomy of angiosperms – Vasudevan Nair
 - Taxonomy of Vascular plants – Lawrence G.H.M.
 - Text book of Modern plant pathology – K.S.Bilgrami & H.C.Dube
 - The evolution and classification of flowering plants – Cronquist A.
 - Woodland, D.W. (1991) – Contemporary plant systematics : Pentice Hall, New Jersey
 - Pharmacognosy – Kokate et al.
 - Herbal drug technology – Agrawal S.S. and M.Purohit
 - Encyclopedia of medicinal plants used in homoeopathy Vol-1&2 – K.S.Gopi
 - Indian medicinal plants: Forgotten healers, a guide to ayurvedic herbal medicine – Prakash Paranjape
 - Practical pharmacognosy – Khandelwar K.R.
 - Biochemical analysis – S. Sadasivam and A. ManiCkam
 - Pharm forestry: Field guide to medicinal plants – Dinesh kumar Tyagi
 - Modern methods of plant analysis Vol-1&2 – Peach and M.V.trecey
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- Davis P. H. and Heywood V.H. (1993) – Principles of Angiosperms Taxonomy, Tobert E. Kreigher Pub. Co. New York
 - Grant. V. (1971) – Plant Speciation – Columbia University Press New York.
 - Harrison, H.J. (1971) – New concepts in flowering plant Taxonomy – Hieman Educational Books Ltd. London
 - Heslop – Harrison J. (1967) – Plant Taxonomy- English Language Book Soc. and Edward Arnold Pub. Ltd. UK.
 - Hey wood. V.H. and Moore D.M. (1984) – Current concepts in plant Taxonomy, - Academic press, London.
 - Jones A.D. and Wilbins, A.D. (1971) – Variation and adaptations in plant, species. Hieman & Co-Educational Books Ltd. London.
 - Jones S.B. Jr. and Luchsinger, A.E. (1986) – Plant systmatics (2nd edition), Mc Graw Hill Book Co., New York.
 - Nordenstam, B.EL Gazaly, G. and Kassas, M. Zooo – Plant systematic for 21st Century. Portland press Ltd. London.
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- Biochemistry by Mathews C.F. (2003) - Addison Wesley, New Delhi
 - Gill P.S. (2000) - Plant Physiology, S.Chand & Co. New Delhi
 - Jain V.K. (:):Fundamental of Plant Physiology, S.Chand &Co., New Delhi
 - Jayaraman J. (1992) - Laboratory Manual in Biochemistry, Wiley Eastern Ltd., New Delhi
 - Plant Taxonomy and Bio Systematics (2nd, edition) – Edward Arnold Ltd. London
 - Radford, A.E. (1986) – Fundamentals of plant systematics – Harper & Row Publications, USA.
 - Rastogi (2000) - Biochemistry Tata McGraw Hill, New York
 - Salisbury P.B. & W. Ross (1992) - Plant Physiology , New York Pub. Co. California USA
 - Shrivastava H.S. (1993) - Elements of Biochemistry Rastogi Publication, Meerut
 - Shrivastava H.S.(2000) - Plant Physiology, Rastogi Publication, Meerut
 - Stebbins G.L. (1974) – Flowering plant Evolution Above species level – Edward Arnold Ltd., London.
 - Subhash Chandra Dutta (1992) - Plant Physiology, Wiley Eastern, New Delhi
 - Verma V. (1995) - Text book of Plant Physiology, Emkay Publication N.Delhi
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| □ | A manual of laboratory experiments in cell biology | C Edward Gasque | Universal book Stall, New Delhi. |
| □ | An Introduction to Microbiology | P. Tauro, K.K. Kapoor, K S Yadav | Wiley Eastrevn Limited, New Delhi. |
| □ | Applied Microbiology | Vinita Kale, Kishore Bhusari | Himalaya publishing House, Mumbai. |
| □ | Biochemical methods 2 nd ed. | S. Sadasivam, A. Manickam. | New Age International Publisher (P) Ltd, New Delhi. |

<input type="checkbox"/>	Biotechniques Theory and Practice	S Y S Rana	Rastogi Publications, Meerat 250002
<input type="checkbox"/>	Experiments in Microbiology, Plant Pathology and Tissue Culture	K.R. Aneja,	Wishwa Prakashan, New Delhi.
<input type="checkbox"/>	Frontiers in Applied Microbiology	K.G. Mukerji, N C Pathak, Vedpal Sing	Print Hall, Lucknow
<input type="checkbox"/>	Industrial Microbiology	Richard W Thomas	Dowden, Hutchinson & Ross Inc. Stroudtiury Penasytuna.
<input type="checkbox"/>	Instrumental Methods of Chemical Analysis 5 th Ed.	Galen W Ewing.	Mc Graw Hill International
<input type="checkbox"/>	Microbial Genetics	Stanley R Maloy, John E. Cronan David Freitelder	Narosa Publishing House, New Delhi.
<input type="checkbox"/>	Modern experimental biochemistry 3 rd ed.	Rodney Boyer	Pearson education Inc.
<input type="checkbox"/>	Plant tissue culture	Kalyan Kumar DC	New Central Book Agency (P) Ltd. Calcutta 700009.
<input type="checkbox"/>	Practical Microscopy	Martin and Johnsen	Blackie and Sen Limited, London
<input type="checkbox"/>	Research Experiences in plant physiology.-A Laboratory Mannual	Thomas C. Moore	Spinger-Verlag,Berlin.
<input type="checkbox"/>	Biophysical Chemistry.	M. Sataske, Y. Hayashi, M.S. Sethi, S A Iqbal,	Discovery Publishing House (1997) New Delhi – 110002.
<input type="checkbox"/>	Instrumental Methods of Chemical Analysis 5 th Ed.	Galen W Ewing.	Mc Graw Hill International
<input type="checkbox"/>	Practical Microbiology.	R. C. Dubey, D K Maheshwari	S Chand and company Ltd. New Delhi
	A manual of laboratory experiments in cell biology	C Edward Gasque	Universal book Stall, New Delhi.
	An Introduction to Microbiology	P. Tauro, K.K. Kapoor, K S Yadav	Wiley Eastrevn Limited, New Delhi.
	Applied Microbiology	Vinita Kale, Kishore Bhusari	Himalaya publishing Hourse, Mumbai.
	Biochemical methods 2 nd ed.	S. Sadasivam, A. Manickam.	New Age International Publisher (P) Ltd, New Delhi.
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Modern experimental biochemistry 3 rd ed.	Rodney Boyer	Pearson education Inc.
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Practical Microscopy	Martin and Johnsen	Blackie and Sen Limited, London
Research Experiences in plant physiology.-A Laboratory Mannual	Thomas C. Moore	Spinger-Verlag,Berlin.