**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**SEMESTER PATTERN**

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

# M. Sc. FIRST YEAR
# SEMESTER-I & II
# BOTANY– CURRICULUM

**JUNE, 2014**

# SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

## CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**CURRICULUM DESIGNING COMMITTEE**

| | | |
|---|---|---|
| 1. | **Dr.Bodke S.S.**<br>Yeshwant Mahavidyalaya, Nanded | Chairman |
| 2. | **Dr. Kadam A.S.**<br>D.S.M. Mahavidyalaya, Jintur | Member |
| 3. | **Dr. Mandge S.V**.<br>Shri. SGM College, Loha | Member |
| 4. | **Dr. Gawai D.U.**<br>Science College, Nanded | Member |
| 5. | **Dr. Dakore H.G.**<br>P.N.College, Nanded | Member |
| 6. | **Dr. Aithal S.V**.<br>Vai. D.M.Mahavidyalaya, Degloor | Member |
| 7. | **Dr. Biradar S.D.**<br>D.S.M.College, Parbhani | Member |
| 8. | **Dr. Bhadraiah B.**<br>Osmania University, Hyderbad | Member |
| 9. | **Dr. Patil D.A.**<br>SSVP's Dr. Ghogre Science College, Dhule | Member |
| 10. | **Dr. Mukadam D.S.**<br>Green Gold seeds Ltd., Walunj | Member |
| 11. | **Dr. Gacche R.N.**<br>SRTM University, Nanded | Member |

# SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

## CHOICE BASED CREDIT SYSTEM (CBCS)

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**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

### 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. Now University is going one step ahead to implement Cumulative Grade Point Average (**CGPA**) system for UG and Choice Based Credit System (**CBCS**) 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**.

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 M.Sc. Botany (General) semester pattern course is running in different affiliated colleges of the SRTMUN. The course content has been designed on 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, weightage of maximum marks and credits are mentioned. A list of practical exercises for laboratory course work based on theory papers to be completed in the academic year is also given. A list of selected reading material and a common skeleton question paper for all the theory papers of semester-I&II are also provided at the end of the syllabus.

**Dr. BODKE SHRIRANG SATWAJI**
Chairman, BOS in Botany,
SRTMU Nanded

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

# SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

## 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

**Dr. BODKE SHRIRANG SATWAJI**
Chairman, BOS in Botany,
SRTMU Nanded

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

## M. Sc. FIRST YEAR BOTANY CURRICULUM

### Semester-I

**An Outline:**

| Paper number & Title | Credits (Marks) | | | Periods |
|---|---|---|---|---|
| | External: ESE | Internal: CA | Total Credits (Marks) | |
| **Theory Paper-I:** Biology and Diversity of Microbes | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| **Theory Paper-II:** Biology and Diversity of Cryptogams | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| **Theory Paper-III:** Diversity of Seed Plants and Their Systematics | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| ***Theory Paper-IV:** Plant Structure and Developmental Biology **(Elective)** | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| **Theory Paper-V:** Seminar | - | Credit: 01 (Marks:25) | Credits: 01 (Marks:25) | - |
| **Total** | Credit: 12 (Marks: 300) | Credit: 05 (Marks:125) | Credits: 17 (Marks:425) | 240 |

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

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# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

## M. Sc. FIRST YEAR BOTANY CURRICULUM

## Semester-II

### An Outline:

| Paper number & Title | Credits (Marks) | | | Periods |
|---|---|---|---|---|
| | External: ESE | Internal: CA | Total Credits (Marks) | |
| **Theory Paper-VI:** Instrumentation and Methods In Biology | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| **Theory Paper-VII:** Cell Biology, Genetics and Plant Breeding | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| **Theory Paper-VIII:** Plant Ecology, Environmental Biology and Phytogeography | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| ***Theory Paper-IX:** Plant Resource Utilization and Conservation **(Elective)** | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) (2 Test: 15 marks, Assignments: 10marks) | Credits: 04 (Marks:100) | 60 |
| **Theory Paper-X:** Seminar | - | Credit: 01 (Marks:25) | Credits: 01 (Marks:25) | - |
| **Total** | Credit: 12 (Marks: 300) | Credit: 05 (Marks:125) | Credits: 17 (Marks:425) | 240 |

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

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**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

## M. Sc. FIRST YEAR BOTANY LABORATORY COURSE WORK

**Annual Pattern**

### An Outline:

| Paper number & Title | Credits (Marks) | | | Practicals |
|---|---|---|---|---|
| | External: ESE | Internal: CA | Total Credits (Marks) | |
| **Laboratory Course Work-I:** Based on theory paper-I&II | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) | Credits: 04 (Marks:100) | 15 |
| **Laboratory Course Work-II:** Based on theory paper-III&IV | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) | Credits: 04 (Marks:100) | 15 |
| **Laboratory Course Work-III:** Based on theory paper-VI&VII | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) | Credits: 04 (Marks:100) | 15 |
| **Laboratory Course Work-IV:** Based on theory paper-VIII&IX | Credit: 03 (Marks:75) | Credit: 01 (Marks:25) | Credits: 04 (Marks:100) | 15 |
| **Total** | Credit: 12 (Marks: 300) | Credit: 05 (Marks:125) | Credits: 16 (Marks:425) | 60 |

(**ESE:** End of semester examination, **CA:** Continuous assessment, ***:** Elective paper)

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CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

# M. Sc. FIRST YEAR

# SEMESTER – I

# BOTANY– CURRICULUM

**JUNE, 2014**

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# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

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**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – I**

**BOTANY**

**THEORY PAPER – I: BIOLOGY AND DIVERSITY OF MICROBES**

Periods: 60 Credits: 04

**UNIT –I: VIRUSES, BACTERIA AND MYCOPLASMA** (15 Periods)

**Viruses:** General characters**,** chemical composition, Ultra structure of plant viruses (TMV), Virus multiplication, transmission of plant viruses, Symptoms of viral diseases of plants and Economic importance of viruses. **Bacteria:** General characters, Ultra Structure, Nutrition (Autotrophic, Heterotrophic and Symbiotic), Reproduction (Binary fission, Transformation, Transduction and Conjugation), Symptoms of Bacterial diseases of plants, Economic importance of Bacteria. **Mycoplasma:** General characters, Ultra structure, Symptoms of Mycoplasma diseases of plants, Economic importance of Mycoplasma.

**UNIT – II: MYCOLOGY-I** (15 Periods)

**Fungi:** General characters, Classification (As per Ainsworth, 1973; Alexopoulos and Mims, 1979), Ultra structure of fungal cell, Thallus organization, Nutrition **(**Saprotrophs, Biotrophs, Necrotrophs, Symbiotrophs) and reproduction (Asexual and Sexual). **Fungal Cytology and Genetics:** Heterothallism, Heterokaryosis, Parasexuality, Physiological specialization of pathogenic races.

**UNIT – III: MYCOLOGY-II** (15 Periods)

A comparative account of vegetative and **reproductive structures,** Life cycle patterns and Phylogeny of different fungal groups- Gymnomycota, Mastigomycota and Amastigomycota: Zygomycotina, Ascomycotina, Basidiomycotina and Deteuromycotina

**UNIT – IV: APPLIED MYCOLOGY** (15 Periods)

**Fungi as food and feeds:** Mushrooms – Types, cultivation, nutritional and medicinal value, Role of fungi in food processing. **Fungi in industry:** Production of alcohol, medicine, organic acids and enzymes. **Fungi in agriculture and forestry:** Role of fungi in humus formation, formation of mycorrhizal association with plants; Role of fungi in biological control of pests. **Fungi as bio fertilizers:** Mycorrhizae (Ecto and endo). **Fungi in destruction of articles in daily use:** Wood destruction, spoilage of house hold articles, **Lichens:** General characters, types and economic Importance.

**M. Sc. FIRST YEAR**
**SEMESTER – I**

**BOTANY**
**LABORATORY COURSE WORK: BASED ON THEORY PAPER - I**

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**Practical Exercises:**

1. Preparation of Stains (Cotton blue, Lactophenol, Gram's iodine, Crystal violet, Safranine, light green).
2. Preparation of Culture media (PDA /Czapek Dox Agar/ Nutrient Agar.)
3. Staining of bacteria by simple and Gram's staining method.
4. Isolation and identification of fungi from Air.
5. Isolation and identification of fungi from Soil by dilution plate technique.
6. Effect of carbon sources on spore germination of fungi by hanging drop technique.
7. Effect of nitrogen sources on growth of fungi by colony diameter method.
8. Study of fungi: *Stemonitis, Agaricus, Polyporus, Ganoderma*.
9. Determination of alcohol produced by Yeast (*Saccharomyces cerevisiae* )
10. Estimation of Citric acid produced by *Aspergillus niger*.
11. Determination of antibiotics produced by *Penicillium* sp.
12. Study of symptoms and causal organism of bacterial plant diseases: Citrus canker, Black arm of Cotton, Leaf spot of Mango.
13. Study of symptoms and causal organism of plant diseases caused by Viruses: Yellow vein mosaic of Bhendi, Leaf curl of Tomato, Bean mosaic, Papaya mosaic.
14. Study of symptoms and causal organism of plant diseases caused by Mycoplasma: Little Leaf of Brinjal, Sesamum phyllody and Grassy shoot of Sugar cane.
15. Study of lichens
16. At least one long botanical excursion, several local excursions and visits to Industries, Research institutes, Agriculture universities etc.

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**M. Sc. FIRST YEAR**

**SEMESTER – I**

**BOTANY**

**THEORY PAPER – II: BIOLOGY AND DIVERSITY OF CRYPTOGAMS**

Periods: 60 Credits: 04

**UNIT-I: ALGAE-I** (15 Periods)

**Introduction:** Algal habitats, Thallus organization, evolutionary trends and classification of algae as per F.E. Fritsch (1944) and G.M. Smith (1955). Criteria used in algal classification (Pigments, reserve food materials), flagella, cell wall, ultra cell structure, algal blooms, Reproduction (vegetative, asexual and sexual) and Economic importance

**UNIT-II: ALGAE-II** (15 Periods)

**Study of algal groups:** Chlorophyta, Euglenophyta, Pyrrophyta, Chrysophyta, Phaeophyta, Cyanophyta and Rhodophyta (General characters, Morphology and life history are expected).

**UNIT-III: BRYOPHYTA** (15 Periods)

**Introduction:** Habitat, Habit, distribution and outline of classification of Bryophytes as per Smith (1955) and Proskauer (1957). **Study of Morphology, anatomy and reproductive structures:** Marchantiales, Jungermanniales, Anthocerotales, Sphagnales, Funariales and Polytrichales, Structure and evolution of gametophytes and sporophytes in Bryophytes.

**UNIT-IV: PTERIDOPHYTA AND PALAEOBOTANY** (15 Periods)

**Pteridophyta:** General characters and classification (based on the classification proposed by Smith, 1955; Bold, 1957 and Zimmermann, 1959). Comparative account of morphology and anatomy of gametophyte and sporophytes in Psilotales, Lycopodiales, Equisetales, Filicales and Marsileales. Stelar evolution in Pteridophytes; Heterospory and its biological advantages; Origin of seed habit and Economic importance of Pteridophytes .

**Palaeobotany:** Principles of palaeobotany, importance of fossil plants, General account of Lepidodendrales, Calamitales and Sphenophylalas.

**M. Sc. FIRST YEAR**
**SEMESTER – I**

**BOTANY**
**LABORATORY COURSE WORK: BASED ON THEORY PAPER - II**

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**Practical Exercises:**

1. Collection and preservation of Algae, Bryophytes and Pteridophytes.
2. Isolation of algae from soil and water
3. Description, Identification, and classification of the algae- Chroococcus, *Oscillatoria, Scytonema*
4. Identification, classification and description, of the algae- *Volvox, Hydrodictyon, Pediastrum*
5. Identification, classification and description, of the algae- *Nitella, Laminaria, Sargassum*
6. Identification, classification and description, of the algae- *Fucus*, *Porphyra*, *Polysiphonia*
7. Study of External and Internal Structure of *Marchantia, Pellia*.
8. Study of External and Internal Structure of *Anthoceros, Notothylus*.
9. Study of External and Internal Structure of *Sphagnum*, *Polytrichum*.
10. Study of Morphology, Internal Structure (Double stained slide preparation) and reproductive Structures of *Psilotum, Lycopodium*
11. Study of Morphology, Internal Structure (Double stained slide preparation) and reproductive Structures of *Selaginella, Equisetum, Marsilea*
12. Study of Morphology, Internal Structure (Double stained slide preparation) and reproductive Structures of *Ophioglossum* and *Pteris*
13. Study of fossils- *Lepidodendron* and *Calamities*
14. At least one long and several local Botanical excursions

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**M. Sc. FIRST YEAR**

**SEMESTER – I**

## BOTANY

## THEORY PAPER – III: DIVERSITY OF SEED PLANTS AND THEIR SYSTEMATICS

Periods: 60 Credits: 04

**UNIT-I: GYMNOSPERMS** (15 Periods)

General characters and classification Gymnosperms as proposed by Professor Birbal Sahni (1920), Sporne (1965), S.P. Bhatnagar and Alok Moitra (1996). Comparative account of sporophyte and gametophyte of Cycadales, Ginkgoales, Coniferales and Gnetales. General account of Pteridospermales, Pentoxylales and Cordiatales. Economic importance of Gymnosperms

**UNIT-II: GENERAL PRINCIPLES OF TAXONOMY** (15 Periods)

Principles of taxonomy as applied to the systematic, taxonomic structure, Origin and evolution of Angiosperms. Concept of species-Morphological, Taxonomical, Biological. Categories of classification and rules regarding their nomenclature. ICBN-Principles, rules and recommendations. structural, biochemical and molecular systematics, numerical taxonomy.

**UNIT-III: TAXONOMIC EVIDENCES, TOOLS AND BIOSYSTEMATICS** (15 Periods)

Taxonomic evidences and techniques used in-Morphology, micro morphology and palynology. **Taxonomic tools**- Herbarium, floras, botanical gardens, types and use of keys in plant identification, computers, GPS and GIS. Biosystematics- steps in bio system, biosystematics, category and importance of bio systematic studies

**UNIT-IV: PLANT SYSTEMATICS** (15 Periods)

Comparative account of various systems of classification of angiosperms proposed by Linnaeus, Bentham and Hooker, Engler and Prantl, Hutchinson. Study of comparative account of following Angiospermic families- Magnoliaceae, Ranunculaceae, Brassicaceae, Rosaceae, Fabaceae, Euphorbiaceae, Malvaceae, Dipterocarpaceae, Apiaceae, Asclepiadaceae, Verbenaceae, Solanaceae, Rubiaceae, Cucurbitaceae, Asteraceae, Poaceae, Liliaceae, Orchidaceae.

**M. Sc. FIRST YEAR**
**SEMESTER – I**

**BOTANY**
**LABORATORY COURSE WORK: BASED ON THEORY PAPER - III**

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**Practical Exercises:**

1. Study of Morphology, Internal Structure (Double stained Slide Preparation) and Reproductive Structure of *Thuja* and *Ephedra*.
2. Study of Morphology, Internal Structure (Double stained Slide Preparation) and Reproductive Structure of *Araucaria* and *Ginkgo*.
3. Study of Morphology, Internal Structure (Double stained Slide Preparation) and Reproductive Structure of *Taxus* and *Gnetum*.
4. Study of Fossil Gymnosperms with the help of Slides / Specimens
5. Description and identification of at least three plant species belonging to Family – Magnoliaceae, Ranunculaceae,with their floral formulae and floral diagrams
6. Description and identification of at least three plant species belonging to Family – Brassicaceae, Rosaceae, with their floral formulae and floral diagrams
7. Description and identification of at least three plant species belonging to Family – Fabaceae, Euphorbiaceae, with their floral formulae and floral diagrams
8. Description and identification of at least three plant species belonging to Family – Malvaceae, Dipterocarpaceae, with their floral formulae and floral diagrams
9. Description and identification of at least three plant species belonging to Family – Apiaceae, Asclepiadaceae with their floral formulae and floral diagrams
10. Description and identification of at least three plant species belonging to Family – Verbenaceae, Solanaceae with their floral formulae and floral diagrams
11. Description and identification of at least three plant species belonging to Family – Rubiaceae, Cucurbitaceae with their floral formulae and floral diagrams
12. Description and identification of at least three plant species belonging to Family – Asteraceae, Poaceae with their floral formulae and floral diagrams
13. Description and identification of at least three plant species belonging to Family – Liliaceae, Orchidaceae with their floral formulae and floral diagrams
14. Field trips within and around the campus
15. At least one Botanical excursion, compilation of field notes and preparation of wild and cultivated plants as are abundant

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**M. Sc. FIRST YEAR**

**SEMESTER – I**

**BOTANY**

***THEORY PAPER – IV: PLANT STRUCTURE AND DEVELOPMENTAL BIOLOGY**

(ELECTIVE)

Periods: 60 Credits: 04

**UNIT-I: ROOT AND SHOOT DEVELOPMENT** (15 Periods)

Introduction, importance and scope of histology and anatomy of plants. Organization of root apical meristem (RAM), Vascular tissue differentiation, Lateral root and root hairs. organization of shoot apical meristem (SAM). Types of vegetative shoot apex. Cytological and molecular aspects of SAM. Vascular tissue differentiation- Xylem and phloem. Wood development in relation to environmental factors. Significance of study of three dimensional structure of wood

**UNIT-II: LEAF AND FLORAL DEVELOPMENT** (15 Periods)

Development, types and phyllotaxy of leaf, Leaf structure with reference to C3 and C4 plants, Kranz anatomy and CAM syndrome, Structure and types of stomata and trichomes. Floral meristem and floral development in Arabidopsis and Antirrhinum, Vascular anatomy of flower, Inferior ovary, transition to flowering, Role of floral anatomy in taxonomy

**UNIT-III: CONCEPT OF PLANT DEVELOPMENT (**15)

Potency, Commitments, specification, induction competence determination and differentiation, morphogenetic gradients, cell fate and celllineages, stem cell, genomic equivalence and cytoplasmic determinants, imprinting mutants and transgenic in the analysis of development. Development of male and female gametophytes, pollination, fertilization, development and function of endosperm, Patterns of embryo development, Polyembryony and apomixes, experimental embryology, pollen storage and fertilization.

**UNIT-IV: PALYNOLOGY (**15)

**Palynology-** Importance and scope of palynology, Application of palynology in oil exploration and forensic science. Pollen morphology, **Palynotaxonomy-** Role of palynology in taxonomy, **Palaeopalynology-** Principles, microfossil groups, **Aeropalynology-** Principles, techniques of pollen analysis, pollen calendar its importance, spore allergy, allergic properties of pollen, **Agropalynology-** pollen viability, pollen germination, pollen storage and their significance.

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**M. Sc. FIRST YEAR**

**SEMESTER – I**

**BOTANY**

**LABORATORY COURSE WORK: BASED ON THEORY PAPER - IV**

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**Practical Exercises:**

1. Study of root and shoot apical meristems with the help of permanent slides.
2. Study of epidermal peels for stomatal types / stomatal index
3. Study of trichomes
4. Study of secretary tissues with the help of permanent slides
5. Study of Xylem elements by maceration technique
6. Preparation and staining of slides for the study of floral anatomy by microtome technique.
7. Microscopic examination of Pollengrains by Chitale technique.
8. Pollen viability test by using tetrazolium salts
9. Pollen germination test hanging drop / sitting drop cultures,/ suspension culture or surface culture.
10. Study of monosporic, bisporic and teltrasporic types of embryo sac development through examination of permanent stained serial sections.
11. Study of nuclear cellular endosperm through dissections and staining.
12. Field study of several types of flower with different pollination mechanisms (wind pollination, Bat pollination, bee/butterfly pollination, bird pollination).
13. Preparation of shortlist of ten important firewood and timber wood in the locality (With local names, scientific names, families and their properties).
14. Preparing an inventory of the bamboos and ratoons in the locality (with scientific and local names and various uses with illustrations).
15. Students must attend at least one long and one short botanical excursion arranged by the department and they must a detail report on plant diversity at the time of practical examination.

## M. Sc. FIRST YEAR
## SEMESTER – I
## BOTANY, PAPER-I

**SELECTED READINGS:**


| | | | |
|---|---|---|---|
| 1. | Vashishta B.R. (1990) | Botany for Degree Students Part-I Algae | S. Chand & Co. New Delhi. |
| 2. | Vashishta B.R. (1990) | Botany for Degree Students Part-II Fungi | S. Chand & Co. New Delhi. |
| 3. | Alexopolous C.J. & C.W. Mims (1979) | Introductory Mycology | Wiley Eastern Ltd., New Delhi |
| 4. | Smith G.M. (1971) | Cryptogamic Botany Vol-I. Algae and Fungi | Tata McGraw Hill Publishing Co. New Delhi. |
| 5 | Dubey H.C. (1990) | An Introduction to Fungi | Vikas Publishing House, New Delhi. |
| 6 | Sharma P.D. (1995) | The Fungi | Rastogi & Co., Meerut. |
| 7 | Sharma O.P. (1992) | A Text Book of Thallophytes | Tata McGraw Hill Publishing Co. New Delhi. |
| 8 | Fritsch F.E.(1945) | The Structure and Reproduction of Algae Vol-I & II. | Cambridge University Press. |
| 9 | Chapman V.J. and D.J. Chapman (1962) | The Algae, English Language Book Society | McMillan, London. |
| 10 | Mehrotra R.S. and K.R.Aneja (1990) | Introduction to Mycology | Wiley Eastern Ltd. New Delhi. |
| 11 | Pandey S.N.,P.S. Trivedi and S.P. Mishra ( ) | A Text Book of Botany Vol-I & II | Vikas Publishing House, New Delhi. |
| 12 | Pandey B.P. (2000) | College Botany Vol-I (Algae, Fungi, Bryophytes) | S. Chand & Co. New Delhi. |
| 13 | Pandey B.P. (2000) | College Botany Vol-II (Pteridophyta, Gymnosperms, Paleobotany) | S. Chand & Co. New Delhi. |
| 14 | Clintion A (1958) | Introduction to Bacteria | McMillan, New York. |
| 15 | Bower F.O. (1988) | Primitive Land Plants Vol-I & II | Arihant Publishers, Jaipur. |
| 16 | Gangule H.C. & Kar A.K. (1995) | College Botany Vol-II | New Central Book Agency, Calcutta. |
| 17 | Rajan S. Sundra (1995) | College Botany Vol-I & II | Himalaya Publication House. |
| 18 | Saxena A.K.& Sarabhai R.P. (1968) | Text Book of Botany Vol-I | Ratan Prakashan Mandir, Agra. |
| 19 | Saxena A.K. & Sarabhai R.P. (1968) | Text Book of Botany Vol-II | Ratan Prakashan Mandir, Agra. |
| 20 | Bodke S.S. and N.M.Dhekle (2007) | Diversity of Microbes and Cryptogams | Mansi Prakashan, Nanded |

## M. Sc. FIRST YEAR
## SEMESTER – I
## BOTANY, PAPER-II

**SELECTED READINGS:**


| | | | |
|---|---|---|---|
| 1 | Smith G.M. (1971) | Cryptogamic Botany Vol-II Bryophytes and Ptridophytes | Tata McGraw Hill Publishing Co. New Delhi. |
| 2 | Sharma O.P. (1992) | A Text Book of Pteridophytes | Tata McGraw Hill Publishing Co. New Delhi. |
| 3 | Vashishta B.R. (1990) | Botany for Degree Students Part-III Bryophyta | S. Chand & Co. New Delhi. |
| 4 | Puri P. (1980) | Bryophyta | Atmaram & Sons. New Delhi. |
| 5 | Parihar N.S. (1965) | An Introduction to Embryophyta Vol-I Bryophyta | Central Book Depot, Allahabad. |
| 6 | Vashishta P.C. (1991) | Botany for Degree Students Part-V Vascular Cryptogams (Pteridophyta) | S. Chand & Co. New Delhi. |
| 7 | Parihar N.S. (1965) | An Introduction to Embryophyta Vol-II Pteridophyta | Central Book Depot, Allahabad. |
| 8 | Sharma O.P. (1992) | A Text Book of Pteridophytes | McMillan (India) Ltd |
| 9 | Rashid A (1976) | An Introduction to Pteridophyta | Vikas Publishing House, New Delhi |
| 10 | Sporne K.R. (1976) | The Morphology of Pteridophytes | B.I. Publication, Bombay |
| 11. | Pandey B.P. | Text book of Botany Gymnosperms | S. Chand & Co. Ltd. New Delhi. |
| 12. | Biswas C. B. M. Johri | The Gymnosperms | Narosa Publishing House, New Delhi. |
| 13 | Bodke S.S. and N.M.Dhekle (2009) | Cryptogamic Botany | Sanket Prakashan, Nanded |

## M. Sc. FIRST YEAR
## SEMESTER – I
## BOTANY, PAPER-III

**SELECTED READINGS:**

**1.** Davis P. H. and Heywood V.H. (1993) – Principles of Angiosperms Taxonomy Tobert E. Kreigher Pub. Co. New York
2. Grant. V. (1971) – Plant Speciation – Columbia University Press New York.
**3.** Harrison, H.J. (1971) – New concepts in flowering plant Taxonomy – Hieman Educational Books Ltd. London
4. Heslop – Harrison J. (1967) – Plant Taxonomy- English Language Book Soc. and Edward Arnold Pub. Ltd. UK.
5. Hey wood. V.H. and Moore D.M. (1984) – Current concepts in plant Taxonomy, - Academic press, London.
6. Jones A.D. and Wilbins, A.D. (1971) – Variation and adaptations in plant species. Hieman & Co-Educational Books Ltd. London.
7. Jones S.B. Jr. and Luchsinger, A.E. (1986) – Plant systmatics (2nd edition) Mc Graw Hill Book Co., New York.
8. Nordenstam, B.EL Gazaly, G. and Kassas, M. Zooo – Plant systematic for 21st Century. Portland press Ltd. London.
9. Radford, A.E. (1986) – Fundamentals of plant systematics – Harper & Row Publications, USA.
10. Stebbins G.L. (1974) – Flowering plant Evolution Above species level – Edward Arnold Ltd., London.
7. Plant Taxonomy and Bio Systematics (2nd, edition) – Edward Arnold Ltd. London
8. Takhtajan A.L. (1997) Diversity and classification of flowering plant – Colubia University, press New York.
13. Woodland, D.W. (1991) – Contemporary plant systematics : Pentice Hall, New Jersey.
14. Flora of Osmanabad – V. N. Naik.
15. Flora of Marathwada – Chief Ed. By Dr. V.N. Naik.
16. Bodke S.S. and N.M.Dhekle (2013): Key to selected Angiospermic plants, Kusha Publisher & Distributer, Nanded

## M. Sc. FIRST YEAR
## SEMESTER – I
## BOTANY, PAPER-IV

**SELECTED READINGS:**


| | | | | |
|---|---|---|---|---|
| 1. | Tayal M.S. (1983 | Plant anatomy | | Rastogi Publication, Meerut. |
| 2. | Pandey B.P. (1993) | Plant anatomy | | S. Chand & Co. Pvt. Ltd. |
| 3. | Saxena A.K., & R.P.Sarabhai (1975) | Atext book of Botany Vol – II Embryophyta | | Kitab Ghar, Gwaliar Pergamon Press Oxford. |
| 4. | Singh v, Pande P.C. D.K. Jain (1994) | Anatomy of seed plants. | | Rstogi Publication, Meerut. |
| 5. | Esau K (1977) | Anatomy of seed plants | | John Wiley & Sons, New York |
| 6. | Eames A.J. & L.H. MacDaniel (1974) | Introduction to plant anatomy | New York. | Mc Graw Hill Book Co. |
| 7. | Maheswari P. (1972) | An introduction to embryology of Angiosperms | | Tata Mc Graw Hill Pub. Co. Ltd. New York. |
| 8. | Bhojwani S.S. Bhatnagar S.P.(1974) | Embryology of Angiosperms Angiosperms. | | Vikas Publication House Pvt. Ltd. New Delhi. |
| 9. | Dwivedi J.N. (2000) | Embryology of Angiosperms | | |
| 10. | Bodke S.S. and N.M.Dhekle (2009): | Anatomy, Embryology & Ecology | | Sanket Prakashan, Nanded |

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

# CHOICE BASED CREDIT SYSTEM (CBCS)

# SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – II**

**BOTANY**

**JUNE, 2014**

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – II**

**BOTANY**

**THEORY PAPER – VI: INSTRUMENTATION AND METHODS IN BIOLOGY**

Periods: 60 Credits: 04

**Unit-I: INSTRUMENTATION-I** (15 Periods)

**Safety in laboratory -** Safe use of laboratory equipments, Personal protection,Hazards and waste disposal. **Microscopy –** Working and application of simple microscope, compound microscope, Dark field microscope, phase contrast microscope, fluorescence microscope, scanning and transmission electron microscope, cytophotometry and flow cytometry, Micrometry ,fixation and staining, **Sterilization methods**.(Autoclave, Hot air oven and Filtration ).

**Unit-II: INSTRUMENTATION-II (**15 Periods)

Principles , working and applications of Laminar air flow, pH Meter, Colorimeter and Spectrophotometer (visible and UV), Paper chromatography,Principles and application of gel filtration, Ion exchange and affinity chromatography, Column chromatography, TLC and Gas chromatography, HPLC, HPTLC, Electrophoresis & Electrofocussing, Ultracentrifugation (velocity & buoyant density).

**Unit-III: METHODS IN BIOLOGY-I** (15 Periods)

**Biophysical Methods:** Principle and method of X-ray diffraction, UV visible, fluorescence, NMR and ESR spectroscopy and ORD / CD visible. **Hydrodynamic Methods:** Atomic absorption and plasma emission spectroscopy. Principles and **Application of tracer technique:** Radiation dosimetry, radioactive isotopes and half life of isotopes, autoradiography, effect of radiations on biological systems

**Unit-IV: METHODS IN BIOLOGY-II** (15 Periods)

**Histochemical and Immunotechniques:** Antibody generation, detection of molecules using ELISA, RIA, Western blot, immunoprecipitation, fluocytometry and immunofluorescence microscopy, detection of molecules in living cells, in-situ localization by techniques- FISH and GISH. **Molecular Biology Methods:** Analysis of RNA, DNA and proteins by one and two diamensional gel electrophoresis, isolation, separation and analysis of carbohydrate and lipid molecules, RFLP, RAPD and AFLP techniques.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – II**

**BOTANY**

**LABORATORY COURSE WORK: BASED ON THEORY PAPER - VI**

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**Practical Exercises:**

1. Rules and regulations for safety in laboratory.
2. Study the principle and working of compound microscope.
3. Sterilization of Media/Glassware with the help of autoclave and hot air oven.
4. Calibration of Microscope and measurement of microorganisms.
5. Study the principle and working of pH meter and measurement of pH of soil / solutions.
6. Study the principle and working of colorimeter, Spectrophotometer and centrifuge.
7. Separation of amino acids by paper chromatography or paper electrophoresis
8. Separation of chlorophyll pigments by thin layer chromatography.
9. Detection of plant proteins by Polyacrylamide Gel Electrophoresis.
10. Detection of molecules using ELISA
11. Analysis of DNA and RNA by one and two dimensional gel electrophoresis,
12. Isolation, separation and analysis of carbohydrate molecules from plant material.
13. Isolation, separation and analysis of lipid molecules from plant material.
14. Effect of radiations on biological systems (Seed germination )
15. Visit to research centre (CCMB, NCL, CFTRI, ICRISAT, and BARC), Biotechnology/ Tissue culture laboratories, Agriculture Universities, Pharmaceutical industries etc.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – II**

**BOTANY**

**THEORY PAPER – VII: CELL BIOLOGY, GENETICS AND PLANT BREEDING**

Periods: 60 Credits: 04

**Unit-I: CELL BIOLOGY-I** (15 Periods)

Structure and function of prokaryotic and eukaryotic cells, Structural organization and function of Cell wall, Mitochondria, Vacuoles, Chloroplast. **Chromosome-** structure and function; Heterochromatin, Euchromatin. **Cell division and cell cycle-** Mitosis, Meiosis and their regulation steps in cell cycle, regulation and control of cell cycle. Structure and function of cytoskeleton. **Membrane structure and function-** lipid bilayer and membrane protein. Cell signalling and cell receptors, G-Protein Coupled Receptor, signal transduction.

**Unit-II: GENETICS-I** (15 Periods)

**Crossing over-** Types, mechanism of meiotic crossing over, significance of crossing over. Linkage map or genetic mapping: linkage groups, map distance, gene order, interference and coincidence, chromosome: physical or cytological mapping, Characters of multiple alleles; examples: A, B, AB and O blood groups in humans, Rh factor, **Linkage –** Types of linkage, deletion of linkage, Sex linked inheritance, sex determination and molecular basis of sex differentiation

**Unit-III: GENETICS-II** (15 Periods)

Gene structure and regulation of gene expression, Extra chromosomal inheritance (Episomes, Mitochondria and Chloroplasts), Transposons, Karyotype. **Mutation –** types of mutation, reverse mutation, application of mutation. Chromosomal aberrations- deletions, duplication, inversion, translocation, variation in chromosome morphology. Dose Compensation, **Population genetics**: Hardy- Weinberg law : genetic equilibrium; application of Hardy- Weinberg law in calculating gene frequencies in a population

**Unit-IV: PLANT BREEDING** (15 Periods)

**Genetic analysis in plant breeding**: Concepts of a population and gene pool, concepts of population genetics: Quantitative traits and Polygenes and polygenic inheritance; **Tools in plant breeding**: Sexual hybridization and wide crosses, Tissue culture and the breeding of clonally propagated plants, Mutagenesis, Polyploidy, Biotechnology, Issues in the application of biotechnology in plant breeding

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – II**

**BOTANY**

**LABORATORY COURSE WORK: BASED ON THEORY PAPER - VII**

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**Practical Exercises:**

1. Study of different stages of mitosis and determination of mitotic index in *Allium/ Aloe/ Chlorophytum/Pea*
2. Study of mitotic abnormalities in *Allium* cells by chemical treatments.
3. Study of different stages of meiosis and meiotic irregularities in *Allium* and *Rhoeo/ Tradeschantia*
4. Isolation of Mitochondria from eukaryotic cell
5. Isolation of Chloroplasts from plant cell
6. Study of ultramicroscopic structures of cell organelles with the help of Photographs (Golgi apparatus, Ribosomes,Chloroplast,Mitochondria E.R. and Nucleus,)
7. Study of mutation in Yeast/Bacteria by replica plate technique.
8. Study of Karyotype and ideogram in plants/ human
9. Determination of blood grouping
10. Problems based on Multiple alleles.
11. Problems based on Gene mapping
12. Problems based on linkage
13. Problems based on Hardy Weinberg equation
14. Visit to research institutes / Biotechnology/ Tissue culture laboratories / Agriculture Universities

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR**

**SEMESTER – II**

**BOTANY**

**THEORY PAPER – VIII: PLANT ECOLOGY, ENVIRONMENTAL BIOLOGY AND PHYTOGEOGRAPHY**

Periods: 60 Credits: 04

**Unit-I: ECOLOGY** (15 Periods)

**Introduction-** Scope and importance of ecology in India, Ecological tools and techniques, Sampling techniques of population, methods of estimating primary production and consumer production. **Ecosystems -** Concepts of ecosystem, **Function of Ecosystem** - Energy flow and mineral cycling (C, N, P), **Structure and function of some Indian ecosystems –** Terrestrial ecosystem (Grassland and Forest ecosystem), Aquatic ecosystem (Fresh water, marine and estuarine ecosystem), Food chains, Food webs and ecological pyramids

**Unit-II: POPULATION ECOLOGY** (15 Periods)

Characterization of a population, population growth curves, population regulation, life history strategies (Y and K selection), **Concepts of metapopulation-** demes and dispersal, interdemic extinctions, age structured populations. **Community ecology-** Nature of communities, community structure, levels of species diversity and its measurement, edges and ecotones. **Ecological succession –** Types, mechanism, changes involved in succession, concept of climax.

**Unit-III: ENVIRONMENT AL BIOLOGY** (15 Periods)

**The Environment** – Physical and biotic environment, biotic and abiotic interactions. **Environmental pollution –** Causes, effects and control measures of air, water, soil and thermal pollution, Nuclear hazards, phytoremediation, Global warming and climate change, acid rains, ozone layer, ozone hole. **Social issues and the environment –** EPA 1986, Urban problems related to energy, water conservation, rain water harvesting, environmental ethics, issues and possible solutions.

**Unit-IV: PHYTOGEOGRAPHY** (15 Periods)

Introduction, concept, phytogeographical regions of India, Ecological importance of forests, aforestation, deforestation, social forestry, Endemism, endemic and endangered species of India, IUCN categories, Red data books, Biodiversity and its conservation, Protected area network, convention on biological diversity, concept of sustainable development.

**M. Sc. FIRST YEAR**
**SEMESTER – II**

**BOTANY**
**LABORATORY COURSE WORK: BASED ON THEORY PAPER - VIII**

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**Practical Exercises:**

1. To calculate mean, variance, standard deviation, standard error, coefficient of variation and to use test for comparing two means related ecological data.
2. To find out the relationship between two ecological variables using correlation and regression analysis.
3. To study the vegetation by Line Transect method
4. To determine minimum size and number of quadrates required for reliable estimate of biomass in grassland.
5. To determine **IVI** of the species in grass land using suitable method & state whether vegetation is homogeneous or heterogeneous.
6. To determine gross and net phytoplankton productivity by light & dark bottle method.
7. To determine the soil carbonates by rapid titration method.
8. To find out association between important grassland species using Chi-square test.
9. To determine the water holding capacity of soils collected from different locations.
10. To determine percent organic carbon and organic matter in the soils of cropland, grassland & forest
11. To estimate the dissolved oxygen content in eutrophic and oligotrophic water samples by Winkler's method.
12. To determine the biochemical oxygen demand (BOD) of polluted water.
13. To estimate chlorophyll content in $SO_2$ fumigation and unfumigated plants leaves.
14. Scientific visits to Biosphere reserves, National park, Sanctuary, Mangrove vegetation, NBPGR New Delhi or its regional circles, Head quarters of BSI or its regional circles, CSIR labs doing research on plant utilization, ICAR research station or field station, Recognized botanical garden / museum (FRI Dehradun, NBRI – Lucknow. Tropical botanical garden and research institute Trivendrum)

**M. Sc. FIRST YEAR**
**SEMESTER – II**

**BOTANY**
***THEORY PAPER – IX: PLANT RESOURCE UTILIZATION AND CONSERVATION**
(ELECTIVE)

Periods: 60 Credits: 04

**Unit-I: PLANT RESOURCE DEVELOPMENT – I** (15 Periods)
Domestification and introduction of plants, origin of cultivated plants, plants as source of food, fodder, fibre, spices, beverages, edible oils, drugs, narcotics, insecticides, timber, gums, resins, dyes, latex, cellulose, starch, and its products. Importance of ethno botany in Indian context.

**Unit-II: PLANTS AND CIVILIZATION** (15 Periods)
Centres of origin and gene diversity, Vavilov's centers of origin, Botany, utilization, cultivation of plants and improvement of food, drugs, fiber and their industrial values, unexploited plants of potential economic values, plants as source of renewable energy, genetic resources and their conservation, tissue culture in plant propagation and enrichment of genetic diversity, role of biotechnology in agriculture, medicine, industry and green house technology. The structure of plant based industries in Maharashtra, the present scenario and future prospectus.

**Unit-III: CONSERVATION-I** (15 Periods)
**Green revolution-** Benefits and adverse consequences, Principles of conservation, major approaches to conservation and current practices in conservation of genetic diversity, species diversity, ecosystem diversity. **Conservation strategies –** In-situ conservation, Indian case studies on conservation strategies- project tiger, biosphere reserves, sanctuaries, National parks, Mangroves, on-farm and home garden conservation.

**Unit-IV: CONSERVATION-II** (15 Periods)
**Conservation strategies –** Ex-situ conservation, principles and practices, germ plasm collections, Botanic gardens, seed banks, test tube gene banks, pollen banks, cryobanks, ex-situ conservation of microbes Social approaches to conservation- sacred groves, sthalavrikshas peoples movement for biodiversity conservation- Chipko movement, Chipko river dam and tribal campaign. Role of universities and other educational institutions in biodiversity conservation. Role of BSI, NBPGR, ICAR, CSIR and Department of Biotechnology in sustainable development.

**SEMESTER – II**

**BOTANY**
**LABORATORY COURSE WORK: BASED ON THEORY PAPER - IX**

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**Practical Exercises:**

1. Study of important food, fodder plants.
2. Study of important vegetable, fruits, spices and oil yielding plants.
3. Micro chemical tests for food materials form cereals, pulses, oils/fats, spices.
4. Study of morphology, anatomy, microscopic study of whole fibre using appropriate stain of textile fibres (cotton, jute) cordage fibre (coir)
5. To estimate the reducing and non-reducing sugars from different fruit juices and food materials.
6. Study of some important medicinal plants (Neem, Adhatoda, Ocimum, Garlic Aloe,)
7. Study of some important medicinal plants (Mentha, Withania, Asparagus, Brahmi)
8. Performing simple tests for gums, resins, dyes, and to understand their chemical nature in water.
9. Performing simple test for Narcotics, insecticides, & beverages.
10. To estimate Iodine number of fats.
11. To estimate protein from food materials by suitable method.
12. To estimate carbohydrates from food materials by suitable method.
13. Case studies on conservation strategies in India.
14. Scientific visits to Biosphere reserves, National parks, Sanctuary, A mangrove forests, NBPGR New Delhi or its regional circles, Head quarters of BSI or one of its regional circles.
15. Scientific visits to CSIR laboratories, doing research on plant utilization, ICAR research station or field station, Recognized botanical garden/museum (FRI Dehradun, NBRI-Lucknow, Tropical botanical garden and research institute Trivendrum).

## SEMESTER – II
## BOTANY, PAPER-VI

**SELECTED READINGS:**

| Sr. No. | Name of Book | Name of Author | Publisher |
|---|---|---|---|
| 1. | Biophysical Chemistry. | M. Sataske, Y. Hayashi, M.S. Sethi, S A Iqbal, | Discovery Publishing House (1997) New Delhi – 110002. |
| 2 | Practical Microbiology. | R. C. Dubey, D K Maheshwari | S Chand and company Ltd. New Delhi |
| 3 | Instrumental Methods of Chemical Analysis 5th Ed. | Galen W Ewing. | Mc Graw Hill International |
| 4 | Biotechniques Theory and Practice | S Y S Rana | Rastogi Publications, Meerat 250002 |
| 5 | A manual of laboratory experiments in cell biology | C Edward Gasque | Universal book Stall, New Delhi. |
| 6 | Plant tissue culture | Kalyan Kumar DC | New Central Book Agency (P) Ltd. Calcutta 700009. |
| 7 | Modern experimental biochemistry 3rd ed. | Rodney Boyer | Pearson education Inc. |
| 8 | Research Experiences in plant physiology.-A Laboratary Mannual | Thomas C. Moore | Spinger-Verlag,Berlin. |
| 9 | Biochemical methods 2nd ed. | S. Sadasivam, A. Manickam. | New Age International Publisher (P) Ltd, New Delhi. |
| 10 | Experiments in Microbiology, Plant Pathology and Tissue Culture | K.R. Aneja, | Wishwa Prakashan, New Delhi. |
| 11 | Applied Microbiology | Vinita Kale, Kishore Bhusari | Himalaya publishing Hourse, Mumbai. |
| 12 | An Introduction to Microbiology | P. Tauro, K.K. Kapoor, K S Yadav | Wiley Eastrevn Limited, New Delhi. |
| 13 | Frontiers in Applied Microbiology | K.G. Mukerji, N C Pathak, Vedpal Sing | Print Hall, Lucknow |
| 14 | Practical Microscopy | Martin and Johnsen | Blackie and Sen Limited, London |
| 15 | Microbial Genetics | Stanley R Maloy, John E. Cronan David Freitelder | Narosa Publishing House, New Delhi. |
| 16 | Industrial Microbiology | Richard W Thomas | Dowden, Hutchinson & Ross Inc. Stroudtiury Penasytuna. |

## SEMESTER – II
## BOTANY, PAPER-VII

**SELECTED READINGS:**

| Sr. | Name of Book | Name of Author | Publisher |
|---|---|---|---|
| 1. | Molecular Biology of Gene | J.D. Watson<br>T.A. Baker<br>S.P. Bell<br>Alexander Gann<br>Michael Levine<br>Richard Losick | Pearson Education<br>Singapore, Pvt.Ltd.<br>Indiam Branch<br>482 FIE Patporganj<br>Delhi 110 092. |
| 2. | Genes – Vol. V, VI & VII | Benjamin Lewin | Oxfor University<br>Press New York. |
| 3. | Basic Human Genetics | Elaine Johansen<br>Mange & Arthur<br>Mange | Rastogi Publication.<br>Shivaji Raod, Meerut. |
| 4. | Principles of Genetics | E.J. Gardner,<br>M.J. Simmons<br>D.P. Snastad | John Willy and Sons<br>Ansari Road, Daryaganj.<br>New Delhi. 110 002. |
| 5. | Genetics Vol. I & II | C.B. Powar | Himalaya Publication<br>New Delhi. |
| 6. | Gentics | B.D. Singh | Kalyani Publishers<br>B-1/1292, Rajander<br>Nagar,<br>Ludhiana – 141 008. |
| 7. | Genetics | P.K. Gupta | Rastogi Publication,<br>Shivaji Raoad,<br>Meerut – 250 002. |
| 8. | Genetics Analysis &<br>Principles | Robert J. Brooker | Addison Wesley<br>Longman Inc.<br>New York. |
| 9. | Molecular Genetics | Gunther S. Stent<br>Richard Calendar<br>DaryaGanj, | CBS Publishers<br>Distributors – 4596/1-A<br><br>New Delhi. – 110 002. |
| 10. | Text Book of Molecular Biology | K.Sivarama Sastry<br>G. Padmanaban<br>C. Subramanayam | MacMillan India Ltd.<br>Delhi. |
| 11. | Cell Biology, Genetics,<br>Molecular Biology,<br>Evolution and Ecology | P.S. Verma<br>V.K. Agarwal | S. Chand Publisher<br>New Delhi. |
| 12. | Cytology Genetics & Evolution. | P.K. Gupta | Rastogi Publication,<br>Meerut. |
| 13. | Cell Structure and Function | Ariel. G. Loewy<br>Philip Siekevit2 | Oxford & IBH Publishing<br>Cor. Pvt. Ltd., Delhi. |
| 14. | Cell Physiology | Arthur Giese | W.B. Saunderies Company,<br>London. |
| 15. | Cell Biology | E.J. Ambrose<br>Dorothy M.Easty | Vikas Publication,<br>Bombay. |
| 16. | Introduction to Cell Biology | S.Sundara Rajan | Vikas Publishing House |

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|---|---|---|---|
| | | Pvt. Ltd. Delhi. | |
| 17. | Cell Biology | C. B. Powar | Himalaya Publishing House. Delhi |
| 18. | Cell Biology | Johnson Lewys | Sarup & Sons New Delhi. – 110 002. |
| 19. | Genetic Engineering | Sandhya Mitra | Mac. Millan India, Ltd. New Delhi |
| 20. | Cytology | P.S. Verma V.K. Agarwal | S.Chand New Delhi. |
| 21. | The Living Cell | Donald Kennedy | W.H. Freeman and Company, Sanfrancisco. |
| 22. | The Science of Genetics | William Hexter H.T. Yost | Prentics-Hall of India India Pvt. Ltd. New Delhi |
| 23. | Studies on Genetics | H.J. Muller | Oxford & IBH Publisher New Delhi. |
| 24. | Genetics | A.M. Winchester | Oxford & IBH Publisher New Delhi. |
| 25. | Genetics | B. guttman, a. Griffiths d. Suzuki t. Cullis. | Oxford Publisher England, London |
| 26. | Fundamentals of Genetics | M.P. Arora | Himalaya Publishing House. Delhi. |
| 27. | The Biology of Cells | Herbert Sterm David L. Nanney | Willey Eastern Pvt. Ltd. New Delhi |
| 28. | Genetic Engineering & its Application. | P. Joshi | Agrobios India Ltd. |
| 29. | Cell and Molecular Biology | S.C. Rastogi | New Age International Publisher. New Delhi. |
| 30. | Cell Biology, Fundamentals and Applications | M.L. Gupta M.L. Jangir | Student Edition India Ltd. , Jodhpur. |

## BOTANY, PAPER-VIII

**SELECTED READINGS:**

| | Title of the Book | Name of the Author | Name of the Publisher |
|---|---|---|---|
| 1. | An Introduction to Environemntal Pollution | Sharma B.K.<br>Kaur H. | Goel Publishing House, Meerut. (1996) |
| 2. | Environemntal Biology | Biswarup Mukherjee | Tata MC Graw Hill Publishing House, New Delhi. (1996) |
| 3. | Environemntal Science & Biotechnology | A.G. Murugesan | MJP Publishers, Chennai. (2005) |
| 4. | Theory & Techniques | C. Rajakumari | |
| 5. | Environemntal Science Systems & Solutions | Michael L. Mc Kinney<br>Robert M. Schoch | Jones & Bastlett Publishers, London. ( 1996) |
| 6. | Environemntal Biology (Principles of Ecology) | P.S. Warma<br>A.K. Agrawal | S. Chand & Co. Ramnager (1993) |
| 7. | Biological Control of Environemntal Pollution | P. Kumar | Sarup & Sons, New Delhi. (2002) |
| 8. | Practical Methods in Ecology and Environmental Science | R.K. Trivedy<br>P.K. Goel<br>C.L. Trisal | Environemntal Publications, Karad. (1987) |
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## BOTANY, PAPER-IX

**SELECTED READINGS:**

| | Title of the Book | Name of the Author | Name of the Publisher |
|---|---|---|---|
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| 02 | Air Pollution Physiological Effects | James J. McGrath<br>Charles D. Barnes | Academic Press,<br>New Yark, Landon. (1987) |
| 03. | Photochemistry Of Air Pollution | Philip A. Leighton | Academic Press,<br>New Yark, Landon. (1961) |
| 04 | Air Pollution (Third Edition Vol. II) | Arthur C. Stern | Academic Press,<br>New Yark, Landon. (1977) |
| 05. | Biodiversity Consevation | Kotwal<br>Bonerjee | Argobios,<br>(India) 2000. |
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| 09. | Molecular Approaches to Ecology | Marcel Florkin and<br>Ernest schoffeniels | Academic press,<br>New Yark. ( 1969) |
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| 17. | Environmental Awareness | Dr. D.N. Khairnar | Vision Publications. |
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| 19. | Air Pollution & Plant Life | Michael Treshow | John Wiley & Sons .(1984) |
| 20. | An advanced text Book on Biodivessity | K.V. Krishnamurthy | Oxford & IBH Publishing,<br>Co. Pvt. Ltd. (2006) |

## SKELETON OF THEORY QUESTION PAPER

M. Sc. FIRST YEAR

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

SEMESTER – I & II

**BOTANY**

**Maximum Marks:** 75

**Credits:** 03

**Time:** 03 Hours

**Note:**

1. Attempt all questions
2. All question carry equal marks
3. Draw neat and well labeled diagrams wherever necessary

**Q1.** Long answer type question (Based on Unit-I) (15)

**OR**

a. Short answer type question (Based on Unit-I) (08)

b. Short answer type question (Based on Unit-I) (07)

**Q2.** Long answer type question (Based on Unit-II) (15)

**OR**

a. Short answer type question (Based on Unit-II) (08)

b. Short answer type question (Based on Unit-II) (07)

**Q3.** Long answer type question (Based on Unit-III) (15)

**OR**

a. Short answer type question (Based on Unit-III) (08)

b. Short answer type question (Based on Unit-III) (07)

**Q4.** Long answer type question (Based on Unit-IV) (15)

**OR**

a. Short answer type question (Based on Unit-IV) (08)

b. Short answer type question (Based on Unit-IV) (07)

**Q5.** Write short notes on any three of the following (15)

1. (Based on Unit-I)
2. (Based on Unit-II)
3. (Based on Unit-III)
4. (Based on Unit-IV)
5. (Based on Unit-I/II/III/IV)

## SKELETON OF PRACTICAL QUESTION PAPER

**M. Sc. FIRST YEAR, SEMESTER – I**

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

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**w. e. f. Academic Year 2014-2015**

# BOTANY

## LABORATORY COURSE WORK-I: BASED ON THEORY PAPER – I & II

**Maximum Marks:** 75

**Credits:** 03

**Time:** 06 Hours

**Note:** (i) Attempt all questions

(ii) Draw neat and well labelled diagrams wherever necessary

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**Q1.** Perform the simple staining / Gram's staining of bacteria from the given bacterial culture (**A).** 10

**Q2.** Identify, classify and describe any two fungi from given fungal culture on the basis of vegetative and reproductive characters / Effect of glucose on fungal spore germination by hanging drop technique (**B)**. 10

**Q3.** Estimation of citric acid produced by *Aspergillus niger*/ Determination of alcohol / antibiotics produced by fungi. 10

**Q4.** Identify, classify and describe any two algae from the given algal mixture / Isolate an alga from the given water sample 10

**Q5.** Identify, classify and describe specimen - C (Bryophytes/ Pteridophytes) 08

**Q6.** Make a double stained permanent preparation the specimen - **D** (Pteridophytes) and describe with well labelled diagram 10

**Q7.** Spotting (Five spots):
(Culture Medium/Stains/ Bacterial disease – 1, Fungal specimen, – 1, Algae – 1, Bryophytes-1, Pteridophytes/Palaeobotany-1) 05

**Q8.** i. Record books 05
ii. Viva voce 04
iii. Excursion report & submission 03

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## SKELETON OF PRACTICAL QUESTION PAPER

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

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**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

**M. Sc. FIRST YEAR, SEMESTER – I**

## BOTANY

**LABORATORY COURSE WORK-II: BASED ON THEORY PAPER – III & IV**

**Maximum Marks:** 75

**Credits:** 03

**Time:** 06 Hours

**Note:** (i) Attempt all questions
(ii) Draw neat and well labelled diagrams wherever necessary

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**Q1.** Prepare a double stained permanent slide from the given specimens-**A** (Gymnosperms). Identify and describe the anatomical characters with well labelled diagram. 10

**Q2.** Identify, classify and describe the given specimens-**B** and **C** (Angiosperms) with floral formula and floral diagram. 12

**Q3.** Identify the genus and species of the given specimen – **D** & **E** with the help of flora. 10

**Q4.** Determine the pollen viability and calculate the percentage of pollen germination By hanging drop technique / Prepare a slide from the given floral bud by microtome technique 10

**Q5.** Identify the xylem elements by maceration technique / examine the type of embryo sac development by permanent stained serial section / examine the pollen grains by Chitale technique and describe the morphology. 08

**Q6.** Identify the types of stomata and calculate the stomata index / Identify the types of trichomes from the given plant material. 08

**Q7.** Spotting (Five spots). Gymnosperms -1, Morphology-1, Economic importance-1, Anatomy-01, Embryology-01). 05

**Q8.** i. Record books 05
ii. Viva voce 04
iii. Excursion report and Submission 03

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

## SKELETON OF PRACTICAL QUESTION PAPER

**M. Sc. FIRST YEAR, SEMESTER – II**

## BOTANY

**LABORATORY COURSE WORK-III: BASED ON THEORY PAPER – VI & VII**

**Maximum Marks:** 75

**Credits:** 03

**Time:** 06 Hours

**Note:** (i) Attempt all questions

(ii) Draw neat and well labelled diagrams wherever necessary

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**Q1.** Measure the pH / Detect the proteins by Polyacrylamide gel electrophoresis from the given sample-**A**. 10

**Q2.** Separate the amino acids by paper chromatography / paper electrophoresis / Separation of chlorophyll pigments by TLC from the given sample-**B**. 10

**Q3.** Analyse the Carbohydrate / Lipid molecules from the given plant material-**C**. 10

**Q4.** Identify and describe any two stages of mitosis and determine the mitotic index / any two stages of meiosis and comment on any one meiotic irregularity from the given material. 10

**Q5.** Make the karyotype and ideogram from the given somatic complement / Isolate Mitochondria / Chloroplast from the given plant material. 08

**Q6.** Solve the given problems based on Multiple alleles / chromosome mapping / Hardy Weinberg equation / Linkage (any two) 10

**Q7.** Identify and comment on the spots (Instruments-2, Cell bilogy-2, Genetics-1) 05

**Q8.** i. Record books 05

ii. Viva voce 04

iii. Excursion report & submission 03

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

# CHOICE BASED CREDIT SYSTEM (CBCS)

## SEMESTER PATTERN

**Faculty of Science**

**Post Graduate (PG) Programmes**

**BOTANY- CURRICULUM**

**w. e. f. Academic Year 2014-2015**

## SKELETON OF PRACTICAL QUESTION PAPER

**M. Sc. FIRST YEAR, SEMESTER – II**

## BOTANY

**LABORATORY COURSE WORK-IV: BASED ON THEORY PAPER – VIII & IX**

**Maximum Marks:** 75

**Credits:** 03

**Time:** 06 Hours

**Note:** (i) Attempt all questions

(ii) Draw neat and well labelled diagrams wherever necessary

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**Q1.** Determine BOD / DO from the given water sample / Determine IVI of the species mentioned in table provided and state whether the vegetation is homogenous or heterogenous. 10

**Q2.** Calculate Mean / Standard deviation / Coefficient of variation on the basis of given data / find out the relationship between two ecological variables using correlation and regression analysis. 10

**Q3.** Determine water holding capacity / Organic Carbon / Organic matter from given soil Sample / Determine the soil carbonates by rapid titration method. 10

**Q4.** Estimate the reducing and non-reducing sugar / total sugar from the given sample / Estimate the iodine number of fats. 10

**Q5.** Estimate the carbohydrates / proteins / fats from the given seed sample by suitable method. 10

**Q6.** Perform qualitative test for gums / resins dyes / narcotics / beverages / insecticides. 08

**Q7.** Spotting (Five spots)
(Medicinal Plants – 01, Fibre yielding plants -01, spices and oil yielding plants-01 Beverages / Narcotics -1, Vegetable / Fruit -1). 05

**Q8.** i. Record books 05
ii. Viva voce 04
iii. Excursion report & submission 03