

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

**B. Sc. GENERAL (SEMESTER PATTERN)**

**B. Sc. SECOND YEAR**

**BOTANY – CURRICULUM  
(MCQ Pattern)**

**w. e. f. JUNE, 2012**

## INTRODUCTION

Revising and updating of the curricula is the continuous process to provide an updated education to the students at large. Up till now there was wide diversity in the curricula of different Indian Universities which inhibited mobility of students in other universities or states. To ensure and have uniform curricula at UG and PG levels in different Indian Universities, the UGC developed a model curriculum and forwarded the same to all the universities in the country to serve as a base in updating their respective curricula.

For developing the final draft of curriculum, the BOS in Botany took into account total number of teaching days available in a year and the guidelines given by the faculty of science of the S.R.T.M.U Nanded. The BOS in Botany held a couple of meetings in which there were thorough and critical discussions.

S.R.T.M.U. Nanded is having B.Sc. (General) Botany course. The course content has been designed on semester pattern.

The course content of each theory paper is divided into units and subunits by giving appropriate titles and subtitles. For each unit, total number of periods required and weightage of maximum marks is mentioned. At the end of each theory paper the list of selected reading material is provided. A list of practical exercises to be completed in the academic year is also given. Paper wise skeleton question paper is provided as a guideline to teachers, students and paper setters.

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## OBJECTIVES

1. To evolve uniform curricula in all the universities of the country and to provide mobility to students from one university or state to other
2. To update curricula by introducing recent advances in the subject and enable the students to face NET, SET UPSC and other competitive examinations successfully.
3. To create awareness among the students about the botany and train them in the subject.
4. To improve the quality of laboratory and field work, for which study tours and excursions have been made compulsory so that the students can become familiar with the flora and ecosystems of that area.
5. To prepare such a dynamic curricula by incorporating innovative concepts and a multidisciplinary approach which can attract and develop interest among the students for selecting plant science as their career.

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## **CURRICULUM DESIGNING COMMITTEE**

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

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**An Outline:**

Semester	Paper No. & Title	Period /practi cal	Marks		
			MCQ Exam.	Internal Exam.	Total
Semester-III	<b>Theory Paper-VI:</b> Morphology and Taxonomy of Angiosperms	45	40	10	50
	<b>Theory Paper-VII:</b> Plant Physiology	45	40	10	50
Semester-IV	<b>Theory Paper-VIII:</b> Seed Plants and Their Utilization	45	40	10	50
	<b>Theory Paper-IX:</b> Plant Metabolism and Biochemistry	45	40	10	50
Annual pattern	<b>Practical Paper-X:</b> Based on Theory Paper-VI&VIII	24	-	-	50
Annual pattern	<b>Practical Paper-XI:</b> Based on Theory Paper-VII&IX	24	-	-	50

**Workload:**

- 1. Theory:** Per paper per week three periods
- 2. Practical:** Per batch per week one practical (Three periods)

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**B. Sc. SECOND YEAR**

**SEMESTER-III**

(MCQ Pattern)

**BOTANY**

**Theory Paper-VI: Morphology and Taxonomy of Angiosperms**

Periods: 45

Marks: 50

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**Unit-I: Morphology of Angiosperms (10 periods):**

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

**Unit-II: Taxonomy of Angiosperms (10 periods):**

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

**Unit-III: Study of families-I (13 periods):**

Distribution, vegetative morphology (habitat, habit, root, stem, leaf) Reproductive morphology (inflorescence, general description of flower, calyx, corolla, androecium, gynoecium, pollination, fruit) floral formula, floral diagram, Systematic position (as per Bentham & Hooker system) distinguishing characters and economic importance of plants (at least two) of the following families:

Annonaceae, Brassicaceae, Malvaceae, Meliaceae, Caesalpinaceae, Fabaceae, Apiaceae.

**Unit-IV: Study of families-II (12 periods):**

Distribution, vegetative morphology (habitat, habit, root, stem, leaf) Reproductive morphology (inflorescence, general description of flower, calyx, corolla, androecium, gynoecium, pollination, fruit) floral formula, floral diagram, Systematic position (as per Bentham & Hooker system) distinguishing characters and economic importance of plants (at least two) of the following families:

Asteraceae, Solanaceae, Euphorbiaceae, Lamiaceae, Liliaceae and Poaceae.

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**SEMESTER-III**

(MCQ Pattern)

**BOTANY**

**Theory Paper-VII: Plant Physiology**

Periods: 45

Marks: 50

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**Unit-I: Plant water relations** (10 periods):

**Importance of water in plant life, Different bio-physico-chemical phenomenon-** Permeability and its importance, definition of diffusion, osmosis (exosmosis, endosmosis) plasmolysis, imbibition. **Absorption of water-** Introduction, mechanism of water absorption (active and passive theories), **Ascent of sap-** Definition, mechanism of root pressure theory, capillary theory, imbibition and transpiration pull theories. **Transpiration-** Definition, types, structure of stomata, mechanism of opening and closing of stomata (starch-sugar theory and  $K^+$  pump theory)

**Unit-II: Mineral nutrition** (10 periods):

**Essential elements:** Major elements (macro nutrients), trace elements (micro nutrients), role of essential elements (deficiency symptoms, diseases and functions). **Mineral salt absorption:** Introduction, mechanism of passive absorption (ion exchange theory), active absorption (carrier concept theory). **Translocation of organic solutes:** Introduction, direction of translocation, mechanism of translocation (Mass flow or Munch hypothesis, protoplasmic streaming theory)

**Unit-III: Growth and development** (10 periods):

**Growth and growth hormones:** Introduction, phases of growth, measurement of growth (arc indicator and Pfeffer's auxanometer) factors affecting growth. **Plant growth substances and other hormones:** Auxins, gibberellins, cytokinins, abscisic acid, ethylene (only practical applications). **Seed dormancy and seed germination:** Seed dormancy- Introduction, methods of breaking seed dormancy, factors affecting seed dormancy; Seed germination- types, factors affecting seed germination.

**Unit-IV: Physiology of flowering and plant movements** (10 periods):

**Physiology of flowering:** Photoperiodism (long day plants, short day plants, day neutral plants), vernalization and devernialization. **Plant movements:** Introduction, classification of movement, movements of curvature and movements of variation (paratonic and nastic movements)

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**B. Sc. SECOND YEAR**

**SEMESTER-IV  
(MCQ Pattern)**

**BOTANY**

**Theory Paper-VIII: Seed Plants and Their Utilization**

Periods: 45

Marks: 50

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**Unit-I: Gymnosperms-I** (12 periods):

Introduction, general characters and classification (Arnold, 1948) of Gymnosperms; Morphology of vegetative and reproductive structures; Anatomy of stem (Primary and secondary growth) and leaf; Reproductive structures (Developmental stages are not expected) and life cycle of Cycas

**Unit-II: Gymnosperms-II** (13 periods):

Morphology of vegetative and reproductive structures; Anatomy of stem (Primary and secondary growth) and leaf; Reproductive structures (Developmental stages are not expected) and life cycle of Pinus and Gnetum

**Unit-III: Utilization of plants-I** (10 periods):

Botanical name, family, distinguishing characters (at least two), method of cultivation and economic importance of the following-  
Food Plants– Cereals (Wheat, Jowar), Pulses (Pigeon pea, Gram) and Fiber yielding plants (Cotton, Sunhemp)

**Unit-IV: Utilization of plants-II** (10 periods):

Botanical name, family, distinguishing characters (at least two), method of cultivation and economic importance of the following-  
Oil yielding plants (Groundnut, Sunflower), Timber yielding plants (Teak, Neem) and Medicinal plants (Aloe, Ocimum, Adathoda, Withania)

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**SEMESTER-IV  
(MCQ Pattern)**

**BOTANY**

**Theory Paper-IX: Plant Metabolism and Biochemistry**

Periods: 45

Marks: 50

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**Unit-I: Photosynthesis and Photorespiration (13 periods):**

Introduction, ultra structure of chloroplast, photosynthetic pigments, concepts of two Photo systems; **Mechanism of photosynthesis:** Light phase- Hill reaction, Cyclic and Non cyclic photophosphorylation (Z- scheme); Dark phase- Calvin cycle ( $C_3$  pathway), Hatch and Slack cycle ( $C_4$  pathway) and Crassulacean acid metabolism (CAM), significance of photosynthesis; **Photorespiration:** Introduction, Glycolate metabolism ( $C_2$  cycle), significance

**Unit-II: Respiration (12 periods):**

Introduction, ultra structure of mitochondria, respiratory quotient and its significance; **Types of respiration:** Aerobic respiration- Glycolysis, Krebs's cycle, Electron Transport System (oxidative phosphorylation), ATP structure and function. Anaerobic respiration- Fermentation (alcoholic and lactic acid) significance of respiration

**Unit-III: Basic Biochemistry (10 periods):**

Introduction different organic constituents of the cell; Biological functions of carbohydrates (monosaccharides / oligosaccharides / polysaccharides) starch, cellulose, hemicellulose, waxes and lipids, proteins and nucleic acids; Biological importance of essential oils, resins, tannins, alkaloids, organic acids, gums and mucilage.

**Unit-IV: Enzymes and Nitrogen metabolism (10 periods):**

**Enzymes:** Introduction, nomenclature and classification (IUB), mechanism of mode of enzyme action (lock and key model, induced fit model) Concept of holoenzyme, apoenzyme, co-enzymes and co-factors. **Nitrogen metabolism:** Introduction, general aspects of nitrogen fixation, Asymbiotic and symbiotic nitrogen fixation, ammonification, nitrification and denitrification.

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**SUGGESTED READINGS :**

- 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 21<sup>st</sup> Century, Portland press Ltd. London.
- Radford, A.E. (1986) – Fundamentals of plant systematics, Harper & Row Publications, USA.
- Stebbins G.L. (1974) – Flowering plant Evolution Above species level,Edward Arnold Ltd., London.
- Plant Taxonomy and Bio Systematics (2<sup>nd</sup>, edition), Edward Arnold Ltd. London
- Takhtajan A.L. (1997) - Diversity and classification of flowering plant, Columbia University, press New York.
- Woodland, D.W. (1991) – Contemporary plant systematics, Pentice Hall, New Jersey.
- Naik, V.N. (1969 ) - Flora of Osmanabad.
- Naik, V.N. (1998) - Flora of Marathwada
- Gill P.S. (2000) - Plant Physiology, S.Chand & Co. New Delhi
- Verma V. (1995) - Text book of Plant Physiology, Emkay Publication N.Delhi
- Salisbury P.B. & W. Ross (1992) - Plant Physiology , New York Pub. Co. California USA
- Subhash Chandra Dutta (1992) - Plant Physiology, Wiley Eastern, New Delhi
- Shrivastava H.S.(2000) - Plant Physiology, Rastogi Publication, Meerut
- Shrivastava H.S. (1993) - Elements of Biochemistry Rastogi Publication, Meerut
- Rastogi (2000) - Biochemistry Tata McGraw Hill, New York
- Biochemistry by Mathews C.F. (2003) - Addison Wesley, New Delhi
- Jayaraman J. (1992) - Laboratory Manual in Biochemistry, Wiley Eastern Ltd., New Delhi

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**Practical Paper-X:** Practical based on theory paper-VI (Semester-III)  
& theory paper-VIII (Semester-IV)

Practicals: 24

Marks: 50

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**Practical 1-4:**

Permanent preparation of

- Pinus- Stem, Needle
- Gnetum- Stem, leaf
- Cycas- Leaf (pinna)

**Practical 5-18:**

- Description, identification and classification of the plants with floral formulae and floral diagrams of their families (mentioned in theory syllabus)

**Practical 19-22:**

- Botanical name, family, distinguishing characters (at least two), method of cultivation and economic importance of the crops as mentioned in theory syllabus

**Practical 23-24:**

- Excursions (One short and one long excursion)

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**Practical Paper-XI:** Practical based on theory paper-VII (Semester-III)  
& theory paper-IX (Semester-IV)

Practicals: 24

Marks: 50

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1. Preparation of standard Graph of Starch using colorimeter/ Spectrophotometer and determination of Starch content from given plant material
  2. Preparation of standard Graph of Glucose using colorimeter/ Spectrophotometer and determination of Glucose content from given plant material
  3. Preparation of standard Graph of Protein using colorimeter/ Spectrophotometer and determination of Protein content from given plant material
  4. Estimate the percentage of oil content in given oilseeds using Soxhlet extractor.
  5. Effect of temperature on plasma membrane (Beet root) in terms of pigment leaked out.
  6. Effect of different organic solvents on plasma membrane (Beet root) in terms of pigment leaked out.
  7. Effect of different concentrations of organic Solvent on plasma membrane (Beet root) in terms of pigment leaked out.
  8. Separation of the Photosynthetic pigments by paper chromatography
  9. Determine the Osmotic Potential of Vacuolar Sap by plasmolysis
  10. Determine the water potential of potato tuber
  11. Identify the amino acids in a mixture and find out the RF value.
  12. Study of catalase activity under different pH
  13. Study of catalase activity under different temperature
  14. Demonstrations of: (Requirements, procedure, workings)
    - a) Moll's half leaf experiments
    - b) Kuhne's fermentation tube

c) R. Q (Carbohydrate / fat/ proteins)

**15. Demonstrations of: (Requirements, procedure, workings)**

- a) Arc indicator (lever auxanometer)
- b) Clinostat (Geotropism)

**16. Demonstration of osmosis by potato osmoscope.**

**17. Micro chemical Test for proteins (Biuret/ Xanthoproteic/ Millon tests)**

**18. Micro chemical Carbohydrate (Molisch /Fehlings /Benedict's) Glucose, sucrose, starch, Cellulose, Pectin**

**19. Micro chemical tests for cutin, Latex, Lignin, Tannin Lipid, fats & oils.**

**20. Micro chemical Test of organic acids – Tartaric acid, Citric acid, Oxalic and Malic acid**

**21-24. Botanical Excursions (one Short excursion and one Long excursion and Visits to laboratories / companies/factory etc**

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## SKELETON OF QUESTION PAPER

### B. Sc. SECOND YEAR

#### BOTANY

**Practical Paper-X:** Practical based on theory paper-VI (Semester-III)  
& theory paper-VIII (Semester-IV)

Time: 4 Hours

Marks: 50

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Date:

Session:

Batch No.:

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**Note:** 1. Draw neat and well labeled diagram wherever necessary  
2. Show your preparation to the examiner

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- |      |   |    |
|------|---|----|
| Q.1  | Make a permanent preparation of the given specimens A identify and describe with well labeled diagram   | 08 |
| Q. 2 | Describe, identity and classify the given specimens B and C to their families with floral formulae and floral diagrams.                         | 12 |
| Q. 3 | Give botanical name, family, distinguishing characters (at least two), method of cultivation and economic importance of given specimens D and E | 10 |
| Q. 4 | Spotting (5 spots) - Describe & identify giving reasons<br>(Gymnosperms-1spot, Morphology- 2 spots, Utilization of plants-2 spots)              | 10 |
| Q. 5 | a) Record Book  | 04 |
|      | b) Submission of field notebook & excursion report  | 03 |
|      | c) Viva-voce  | 03 |

## SKELETON OF QUESTION PAPER

### B. Sc. SECOND YEAR

#### **BOTANY**

**Practical Paper-XI:** Practical based on theory paper-VII (Semester-III)  
& theory paper-IX (Semester-IV)

Time: 4 Hours

Marks: 50

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Date:

Session:

Batch No.:

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**Note:** 1. Draw neat and well labeled diagram wherever necessary  
2. Show your preparation to the examiner

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Q.1 Perform any one experiment (from practical 1-7 by Lottery Method)	10
Q.2 Perform any one experiment (from practical 8 – 13 by Lottery Method)	10
Q.3 Perform any four Micro chemical Tests (from practical 17-20)	10
Q.4 Describe Procedure and working of any two Experiments (from practical 14 – 16)	10
Q.5 A) Record Book	05
B) Viva voce	05