



**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

**BOTANY – CURRICULUM**

**B.Sc. General (Semester Pattern)**

**B. Sc. SECOND YEAR**

**With Effect from June - 2014**



SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

**BOTANY – CURRICULUM**

**B.Sc. General (Semester Pattern)**

**CURRICULUM DESIGNING COMMITTEE**

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

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**B.Sc. General (Semester Pattern)**

**INTRODUCTION**

Revising and updating of the curriculum is the continuous process to provide an updated education to the students at large. Up till now there was 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, curriculum of different Indian Universities and the UGC model curriculum are referred to serve as a base in updating the same.

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. University, 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 weight age of maximum marks is mentioned. The practical exercises to be completed in the academic year are also given. A list of selected reading material is provided at the end of the syllabus.





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**OBJECTIVES**

1. To provide an updated education to the students at large 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 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 curriculum 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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**B.Sc. General (Semester Pattern)**

**Class: B.Sc. I, II & III Year Curriculum - an outline**

Class & Semester	Paper No. & Title	Period /practical	Marks		
			University Examination	Internal Exam	Total
<b>B.Sc. I Year</b> Semester-I	<b>Theory Paper-I:</b> Diversity of Microbes	45	40	10	50
	<b>Theory Paper-II:</b> Cell and Molecular Biology	45	40	10	50
<b>B.Sc. I Year</b> Semester-II	<b>Theory Paper-III:</b> Diversity of Cryptogams	45	40	10	50
	<b>Theory Paper-IV:</b> Genetics and Plant Breeding	45	40	10	50
<b>B.Sc. I Year</b> Annual pattern	<b>Practical Paper-V:</b> Practical based on theory papers of semester-I&II	24	100	-	100
<b>B.Sc. II Year</b> Semester-III	<b>Theory Paper-VI:</b> Morphology and Taxonomy of Angiosperms	45	40	10	50
	<b>Theory Paper-VII:</b> Histology, Anatomy and Embryology of Angiosperms	45	40	10	50
<b>B.Sc. II Year</b> Semester-IV	<b>Theory Paper-VIII:</b> Gymnosperms and Palaeobotany	45	40	10	50
	<b>Theory Paper-IX:</b> Ecology and Environmental biology	45	40	10	50
<b>B.Sc. II Year</b> Annual pattern	<b>Practical Paper-X:</b> Based on Theory Paper-VI&VIII	24	50	-	50
<b>B.Sc. II Year</b> Annual pattern	<b>Practical Paper-XI:</b> Based on Theory Paper-VII&IX	24	50	-	50
<b>B.Sc. III Year</b> Semester-V	<b>Theory Paper-XII:</b> Plant Physiology	45	40	10	50
	<b>Theory Paper-XIII:</b> Optional- any one of the following 1. Plant Pathology-I 2. Systematic botany-I 3. Applied Economic Botany-I 4. Herbal Technology-I	45	40	10	50
<b>B.Sc. III Year</b> Semester-VI	<b>Theory Paper-XIV:</b> Plant Metabolism, Biochemistry and Biotechnology	45	40	10	50
	<b>Theory Paper-XV:</b> Optional- any one of the following 1. Plant Pathology-II 2. Systematic botany-II 3. Applied Economic Botany-II 4. Herbal Technology-II	45	40	10	50
<b>B.Sc. III Year</b> Annual pattern	<b>Practical Paper-XVI:</b> Based on Theory Paper-XII&XIV	24	50	-	50
<b>B.Sc. III Year</b> Annual pattern	<b>Practical Paper-XVII:</b> Based on Theory Paper-XIII&XV	24	50	-	50

**Workload:**     **1. Theory:** Per paper per week three periods  
                       **2. Practical:** Per batch per week one practical of three periods





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**B.Sc. General (Semester Pattern)**

**Class: B.Sc. II Year Curriculum - an outline**

Class & Semester	Paper No. & Title	Period /practical	Marks		
			University Examination	Internal Exam	Total
B.Sc. II Year Semester-III	<b>Theory Paper-VI:</b> Morphology and Taxonomy of Angiosperms	45	40	10	50
	<b>Theory Paper-VII:</b> Histology, Anatomy and Embryology of Angiosperms	45	40	10	50
B.Sc. II Year Semester-IV	<b>Theory Paper-VIII:</b> Gymnosperms and Palaeobotany	45	40	10	50
	<b>Theory Paper-IX:</b> Ecology and Environmental biology	45	40	10	50
B.Sc. II Year Annual pattern	<b>Practical Paper-X:</b> Based on Theory Paper-VI&VIII	24	50	-	50
B.Sc. II Year Annual pattern	<b>Practical Paper-XI:</b> Based on Theory Paper-VII&IX	24	50	-	50

**Workload:**    **1. Theory:** Per paper per week three periods  
                  **2. Practical:** Per batch per week one practical of three periods





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**B.Sc. General (Semester Pattern)**

**B. Sc. SECOND YEAR**

Semester – III

**THEORY PAPER-VI**

**MORPHOLOGY AND TAXONOMY OF ANGIOSPERMS**

***Periods – 45***

***Maximum Marks – 50***

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**UNIT-I: MORPHOLOGY OF ANGIOSPERMS (10 periods)**

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

**UNIT-II: TAXONOMY OF ANGIOSPERMS (10 periods)**

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

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

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

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

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

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**B.Sc. General (Semester Pattern)**

**B. Sc. SECOND YEAR**

Semester – III

**THEORY PAPER-VII**

**HISTOLOGY, ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS**

***Periods – 45***

***Maximum Marks – 50***

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**UNIT –I: HISTOLOGY (10 Period)**

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

**Simple Tissues:** Parenchyma, Collenchyma, Sclerenchyma.

**Complex tissues:** Xylem and Phloem.

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

**UNIT II: ANATOMY (12 Period)**

**Vascular Bundles:** Definition and types.

**Primary structures:**

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

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

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

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

**Anomalous Secondary growth** in Achyranthes stem and Dracaena stem.

**UNIT III: EMBRYOLOGY –I (13 Periods)**

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

**UNIT IV: EMBRYOLOGY –II (10 Period)**

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

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**B. Sc. SECOND YEAR**

Semester – IV

**THEORY PAPER-VIII**

**GYMNOSPERMS AND PALAEOBOTANY**

***Periods – 45***

***Maximum Marks – 50***

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**UNIT-I: GYMNASPERMS (10 periods)**

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

**UNIT-II: PINUS (12 periods)**

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

**UNIT-III: GNETUM (13 periods)**

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

**UNIT-IV: PALAEOBOTANY (10 periods)**

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

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**B. Sc. SECOND YEAR**

Semester – IV

**THEORY PAPER-IX**

**ECOLOGY AND ENVIRONMENTAL BIOLOGY**

***Periods – 45***

***Maximum Marks – 50***

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**UNIT –I: ECOLOGICAL FACTORS (10 Periods)**

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

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

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

**UNIT –III: COMMUNITY ECOLOGY (13 Periods)**

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

**UNIT –IV: ENVIRONMENTAL BIOLOGY (12 Periods)**

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

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Annual Pattern

**PRACTICAL PAPER-X**

**PRACTICAL BASED ON THEORY PAPERS-VI & VIII**

***Practical-24***

***Maximum Marks – 50***

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**Practical Exercises:**

1. Study of Morphology of angiosperms (Root, stem, leaf, inflorescence, flower and fruit as mentioned in syllabus of theory paper-VI) **(6 practical)**
2. Description, floral formula, floral diagram, identification and classification of at least one plant belonging to each family as mentioned in the syllabus of theory paper-VI **(13 practical)**
3. Preparation of double stained permanent slides of *Cycas* pinna, *Pinus* needle and *Gnetum* stem for the study of anatomical structures **(4 practical)**
4. Palaeobotanical study of stem of *Lyginopteris oldhamia* and flower of *Bennettites* **(2 practical)**
5. One short and one long Botanical excursion **(4 practical)**

***Note:*** Students should submit excursion report in detail in the practical examination for evaluation. The report shall carry marks

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**B.Sc. General (Semester Pattern)**

**Skeleton Question Paper**

**B. Sc. SECOND YEAR**

Annual Pattern

**PRACTICAL PAPER-X**

**PRACTICAL BASED ON THEORY PAPERS-VI & VIII**

***Time: Four hours***

***Maximum Marks – 50***

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- Note:**
- (i) *Attempt all questions*
  - (ii) *Show your preparation to the examiner*
  - (iii) *Draw neat and well labeled diagrams wherever necessary*
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- Q1.** Make a double stained permanent preparation, identify and describe the anatomical structures of the given specimen-A (Cycas pinna/ Pinus needle/ Gnetum stem for specimen-A may be given alternately to the students) **(14 marks)**
- Q2.** Describe, identify and classify the given Plant-B & C with floral formulae and floral diagrams (Flowering twigs of the easily available plants for specimen-**B&C** may be given alternately to the students) **(20 marks)**
- Q3.** Identify and describe the spots (Morphology-2 spots and Palaeobotany-1 spot) giving reasons **(06 marks)**
- Q4.**
- i. Record book **(05 marks)**
  - ii. Submission of Excursion report and Collection if any **(03 marks)**
  - iii. Viva-voce **(02 marks)**
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Annual Pattern

**PRACTICAL PAPER-XI**

**PRACTICAL BASED ON THEORY PAPERS-VII & IX**

***Practical– 24***

***Maximum Marks – 50***

**Practical Exercises:**

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

***Note:*** Students should submit excursion report in detail in the practical examination for evaluation. The report shall carry marks





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**Skeleton Question Paper**

**B. Sc. SECOND YEAR**

Annual Pattern

**PRACTICAL PAPER-XI**

**PRACTICAL BASED ON THEORY PAPERS-VII & IX**

***Time: Four hours***

***Maximum Marks – 50***

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- Note:**
- (i) *Attempt all questions*
  - (ii) *Show your preparation to the examiner*
  - (iii) *Draw neat and well labeled diagrams wherever necessary*
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- Q1.** Make a temporary preparation of the given specimen-A. Identify and describe its internal structure. (The Maize stem / Sunflower stem / Dracaena stem / Achyranthus stem for specimen-A may be given alternately to the students) **(12 marks)**
- Q2.** Make a temporary preparation of the given specimen-B. Identify and describe its internal structures of ecological interest. (The Hydrilla stem/ Nymphaea petiole/ Casuarina stem / Nerium leaf for specimen-B may be given alternately to the students) **(12 marks)**
- Q3.** Determine minimum number of quadrants required/ frequency/ plant biomass/bulk density and porosity of soil/ with the help of data given **(08 marks)**
- Q4.** Identify and describe the given spots (Histology- 2, Embryology -1, and Ecology-1) giving reasons **(08 marks)**
- Q5.**
- i. Record book **(05 marks)**
  - ii. Submission of Excursion report and Collection if any **(03 marks)**
  - iii. Viva-voce **(02 marks)**
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**SELECTED READINGS (Paper-VI & VII):**

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 systematics (2nd edition), Mc Graw Hill Book Co., New York.
8. Nordenstam, B.EL Gazaly, G. and Kassas, M. Zooo – Plant systematic for 21<sup>st</sup> 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.
11. Plant Taxonomy and Bio Systematics (2<sup>nd</sup>, edition) – Edward Arnold Ltd. London
12. 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.

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|--|---|--|
| 1. Sundara Rajan (1998)                      | College Botany<br>Vol.-1 & Vol.-2             | Himalaya Publication<br>House, Nagpur. |
| 2. Dutta A. C. (1968)                        | A Botany for Degree<br>Students               | Oxford Press, London.                  |
| 3. Tayal M. S. (1983)                        | Plant Anatomy                                 | Rastogi Publication, Meerut            |
| 4. Ganguli, Das,Dutta(1981)                  | College Botany<br>Vol.-1 & Vol.-2             | New Central Book Agency<br>Kolkata.    |
| 5. Pandey B. P. (1993)                       | Plant Anatomy                                 | S. Chand & Co. Pvt. Ltd.               |
| 6. Esau K. (1977)                            | Anatomy of seed Plants                        | John Willex & Sons,<br>New York.       |
| 7. Singh V.,Pande P. C.<br>Jain D. K. (1994) | Anatomy of seed Plants                        | Rastogi Publication,Meerut             |
| 8. Earnes A. J. &<br>MacDaniel L.H. (1947)   | Introduction to Plant<br>Anatomy              | Mac Graw Hill Book Co.<br>New York.    |
| 9. Bodke S. S. & Dhekle<br>N.M.(2009)        | Plant Anatomy,<br>Embryology, and Ecology     | Sanket Publication,<br>Nanded.         |
| 10. Rahvan, V. (2000)                        | Developmental Biology<br>of Flowering Plants. | Springerverlag,<br>New York.           |



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11. Pande O. N. & Chanda A. (1993) A Text book of Botany Vikas Publication House

12. Maheshwari P. (1972) An Introduction to Embryology  
Angiosperms

Tata Mc Graw Hill Book  
Publication , N.Y.

13. Bhojwani and Embryology of Angiosperms  
Bhatnager

Vikas Publication House  
New Delhi.

**SELECTED READINGS (PAPER – VIII):**

1	Smith G.M. (1971)	Cryptogamic Botany Vol-II Bryophytes and Pteridophytes	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.







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**SELECTED READINGS (PAPER-IX):**

<b>Title of the Book</b>	<b>Name of the Author</b>	<b>Name of the Publisher</b>
1. An Introduction to Environmental Pollution	Sharma B.K. Kaur H.	Goel Publishing House, Meerut. (1996)
2. Environmental Biology	Biswarup Mukherjee	Tata MC Graw Hill Publishing House, New Delhi. (1996)
3. Environmental Science & Biotechnology	A.G. Murugesan	MJP Publishers, Chennai. (2005)
4. Theory & Techniques	C. Rajakumari	
5. Environmental Science Systems & Solutions	Michael L. Mc Kinney Robert M. Schoch	Jones & Bastlett Publishers, London. ( 1996)
6. Environmental Biology (Principles of Ecology)	P.S. Warma A.K. Agrawal	S. Chand & Co. Ramnager (1993)
7. Biological Control of Environmental Pollution	P. Kumar	Sarup & Sons, New Delhi. (2002)
8. Practical Methods in Ecology and Environmental Science	R.K. Trivedy P.K. Goel C.L. Trisal	Environmental Publications, Karad. (1987)
9. The Ecdogy of Insect Population in Theory and Practice	L.R. Clark P.W. Geier R.D. Hughes R.F. Morris	The English Language Book Society and Chapman & Hall.
10. Environmental Pollution Analysis	S.M. Khopkar	New Age International (P) Ltd., Pubshers. (2001)
11. Environmental Biology	H.R. Singh	S.Chand & Company Ltd. (2005)
12. Environmental Ecology & Pollution	V. Kumaresan N. Arumugum	Saras Publication. (1997)
13. Methods in Environmental Analysis, water soil & air	P.K. Gupta	Agrobios (India). (2000)
14. Environmental Impact of Chemicals. Assessment & Contol	Michael D. Quint David Taylor & Rupert Rurchase	The Royal Society of Chemistry.
15. The Chemical Industry Friend to the Environment	J.A. G. Drake	Royal Society of Chemistry.
16. Preshistroic Man and his Environment	W. Raymond wood R. Bruce Mc Millan	Academic Press, New yark.



**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

**BOTANY – CURRICULUM**

**B.Sc. General (Semester Pattern)**

17.	Recent Advances in Environment Science	K.G. Hiremath	Discovery Publishing House, New Delhi. (2003)
18.	Biodiversity and Sustainable Utilization of Biological Resurces	T. R. Sahu	Scientific Publishers, Jodhpur. (2004)
19.	Environmental Biotechnology	Geetha Bai Ramamurthi Rallapalli S.B. Sullia Aziz Shiralipour Satish kastury	A.P.H. Publishing Corporation. (2002)
20.	Food Nutrition & Environmental Security The road Ahead	`	National Institute of Science Communication, N. Delhi.
21.	Environmental Pollution	Timmy Katyal M. Satake	Anmol Publications, Pvt. Ltd. (1996)
22.	Fondamental Ecology	Arthur S. Boughey	Intext Educatinal Publishers. (1971)
23.	A Test book of Environmental Science	R.N. Trivedi	Anmol Publications, Pvt. Ltd. (1993)
24.	Environmental and Plant Ecology	John R. Etherington	Wiley Eastern Ltd. (1975)
25.	Noise Pollution	Debi Prasad Tripathy	A.P.H. Publishing Corporation. (1998)
26.	Environmental Pollution	Laurent Hodges	HOLT, Rinehart & Winston. Inc. (1973)
27.	Plants and Environment	R.F. Daubenmir	John Wiley & Sons, Inc New York. Chapman & Hall Ltd. London.  (1947).
28.	Pollution Biology	Leslie Read	Academic Press, Inc. (1983).
29.	A Text Book of Energy Ecology Environment & Society	A. Moheshwari Geeta Parmar	Anmol Publication, Pvt. Ltd. (2002)
30.	India's Environment Crises and Responces	J. Bandyopathyay N. D. Jayal U. Schoetlli Chhatrapatising	Natraj Publication, Rajpur Road, Dehradun. ( 1985)



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**BOTANY – CURRICULUM**

**B.Sc. General (Semester Pattern)**

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|-----|---|--|--|
| 31. | Air Pollution Physiological Effects         | James J. McGrath<br>Charles D. Barnes                      | Academic Press,<br>New York, Landon. (1987)        |
| 32. | Photochemistry Of Air Pollution             | Philip A. Leighton   | Academic Press,<br>New York, Landon. (1961)        |
| 33. | Air Pollution<br>(Third Edition<br>Vol. II) | Arthur C. Stern  | Academic Press,<br>New York, Landon. (1977)        |
| 34. | Biodiversity Consevation                    | Kotwal<br>Bonerjee   | Argobios,<br>(India) 2000.                         |
| 35. | Biodiversity                                | Ramamurthi Rallapalli<br>Geetha Bai                        | APH Housing Corporation,<br>New Delhi. (2002)      |
| 36. | Concepts of Ecology                         | Edward J. Kormondy   | Perntice Hall of India Pvt Ltd.<br>(1974)          |
| 37. | Current Pollution<br>Researches in India    | R.K. Trivedy<br>P.K. Goel                                  | Environmental Publications,<br>Karad. (1985)       |
| 38. | Molecular Approaches to<br>Ecology          | Marcel Florkin and<br>Ernest schoffeniels                  | Academic press,<br>New York. ( 1969)               |
| 39. | Fundamentals<br>of Ecology                  | Eugene P. odum   | Natraj Publishers,<br>Dehra Dun. (1996)            |
| 40. | Environmental Studies                       | H. Kaur  | Pragatiprakashan. (2005)                           |
| 41. | Elements of Ecology                         | P. D. Sharma   | Rastogi Publications.                              |
| 42. | Elements of Ecology                         | George L. Clarke   | Johnwiley & sons, Inc.<br>New Year, London. (1954) |
| 43. | Ecology & nvironment                        | P.D. Sharma  | Rastogi Publications. (1996)                       |
| 44. | Environmental Science                       | S.C. Santra  | New Central Book Agency,<br>Pvt. Ltd. (2005)       |
| 45. | Respectives in Environment                  | Dr. S.K. Agarwal<br>J.P. Kaushik<br>K.K. Koul<br>A.K. Jain | A.P.H. Housing Carporation,<br>New Delhi. (1998)   |
| 46. | Environmental Awareness                     | Dr. D.N. Khairnar  | Vision Publications.                               |
| 47. | Environmental Pollution                     | Timmy Katyal<br>M. Satake                                  | Anmol Publications, Pvt. Ltd.<br>(1998)            |



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**BOTANY – CURRICULUM**

**B.Sc. General (Semester Pattern)**

48.	Air Pollution & Plant Life	Michael Treshow	John Wiley & Sons .(1984)
49.	An advanced text Book on Biodiversity	K.V. Krishnamurthy	Oxford & IBH Publishing, Co. Pvt. Ltd. (2006)
50.	Environmental & development	Asish Ghosh	A.P.H. Publishig Corporation, New Delhi. (2000)
51.	Environment Management with Indian Experience	Dlip Roy	A.P.H. Publishig Corporation, New Delhi. (1998)
52.	Environment Globalchanges and challenges	Ram Prakash	ABD Publishers, Jaipur. (2003)
53.	Pollution Control For Agriculture	Raymond C. Loehr	Academic Press. Inc. (1984).
54.	Man and his Environment		John Murray Alberm Marle Street, Landon.
55.	Environmental Problems	P.R. Trivedi Gurdeep Raj	Akashdeep Publishing House, New Delhi. (1997)
56.	Environmental Biology	K.C. Agarwal	Agro Botanica. (1999)
57.	Environmental Challenges	C.K Varshney D.R. Sardesai	Wiley Eastiern Ltd. (1993)
58.	Environmental Impact Assessment & Management	B.B. Hosetti A. Kumar	Daya Publishing House. (1998)
59.	An Introduction to Plant Ecology	A.G. Tanshley	Discovery Publishing House. (2003)
60.	Environmental Impact Assessment	S.A. Abbass D.S. Arya	Discovery Publishing House. (2000)
61.	Plant Ecology	P.L. Kochhar	Ratan Prakaranmandir. (1994)
62.	Introduction to Plant Ecology	Maurice Ashby	Macmillan & English Language Book Society.
63.	Plant Ecology & Phytogeoraphy	V. Kumaresan	Saras Publications. (2001)
64.	Weed Ecology	Steven R. Radosevich Jodies Hott	John Willey & sons. (1984)
65.	Animal Ecology	P.S. Verma V.K. Agarwal	S.Chand & Company Ltd. (1992)



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**BOTANY – CURRICULUM**

**B.Sc. General (Semester Pattern)**

- |     |   |  |   |
|-----|---|--|---|
| 66. | Ecology & Environment                         | P.D. Sharma  | Rastogi Publication.                            |
| 67. | Concepts of Ecology                           | N.Arumugam   | Saras Publications. (2003)                      |
| 68. | ATB of Environmental Studies                  | Erach Bharucha for University Grants Commission    | University Press, (India) Pvt. Ltd. Hyd. (2005) |
| 69. | Environmental Biology (Principles of Ecology) | P.S. Varma<br>V.K. Agarwal                         | S.Chand & Co. Ltd.<br>N. Delhi. (2005)          |
| 70. | Ecology                                       | V.K. Agarwal<br>(Environmental Biology) Usha Gupta | S.Chand & Co. Ltd.<br>N. Delhi. (2004)          |

