Standard Format For Syllabus Framework

SHIVAJI UNIVERSITY, KOLHAPUR.

B

Accredited By NAAC

(2009)

Revised Syllabus For

Bachelor of Science (Part II) Botany

Paper –V, VI - (Semester- III)

and

Paper -VII, VIII - (Semester-IV)

Syllabus to be implemented from June 2014 onwards.

A] **Ordinance and Regulations: (As applicable to Degree Course)**

B] **Shivaji University, Kolhapur**
Revised Syllabus For
Bachelor of Science

1. **TITLE : Subject- Botany**
Optional under the Faculty of Science

2. **YEAR OF IMPLEMENTATION**:- Revised Syllabi will be implemented from June 2014 onwards.

3. PREAMBLE:-

[Note :- The Board of Studies should briefly mention foundation, core and applied components of the course/paper. The student should get into the prime objectives and expected level of study with required outcome in terms of basic and advance knowledge at examination level.**]**

4. GENERAL OBJECTIVES OF THE COURSE:
(as applicable to the Degree concerned)
Objectives:-

1) To impart knowledge of Science is the basic objective of education.
2) To develop scientific attitude is the major objective to make the students open minded, critical, curious.
3) To develop skill in practical work, experiments and laboratory materials and equipments along with the collection and interpretation of scientific data to contribute the science.
4) To understand scientific terms, concepts, facts, phenomenon and their relationships.
5) To make the students aware of natural resources and environment.
6) To provide practical experience to the students as a part of the course to develop scientific ability to work in the field of research and other fields of their own interest and to make them fit for society.
7) To The students are expected to acquire knowledge of plant and related subjects so as to understand natural phenomenon, manipulation of nature and environment in the benefit of human beings.
8) To develop ability for the application of the acquired knowledge to improve agriculture and other related fields to make the country self reliant and sufficient.
9) To create the interest of the society in the subject and scientific hobbies, exhibitions and other similar activities.

5. DURATION

The course shall be a full time course.

6. PATTERN:-

Pattern of Examination will be Semester.

7. FEE STRUCTURE :-

As per Government /University rules.

1. **Refer brochure and prospectus of concern affiliated college/institute to Shivaji University, Kolhapur.**
2. **Other fee will be applicable as per rules and norms of Shivaji University, Kolhapur.**

8. ELIGIBILITY FOR ADMISSION:

As per guidelines obtained from Shivaji University, Kolhapur by following rules and regarding reservations by Govt. of Maharashtra.

9. MEDIUM OF INSTRUCTION:

The medium of instruction shall be in English.

10. STRUCTURE OF COURSE- B. Sc. III Botany (Optional)

SECOND YEAR (SEMESTER III/IV) (NO. OF PAPERS IV)

Sr. No.	**Subjects/Papers**	**Total Marks**
1.	Paper-V	50
2.	Paper-VI	50
3.	Paper-VII	50
4.	Paper-VIII	50
	Practical -I	50
	Practical -II	50
	Total	**300**

11. SCHEME OF TEACHING AND EXAMINATION:-

[The scheme of teaching and examination should be given as applicable to the course/paper concerned.]

SECOND YEAR - SEMESTER – III/ IV : Botany (Optional)

Scheme of Teaching and Examination

Sr. No.	Subject/Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)
		L	T	P	Total	Total
	Semester-III					
1	Paper-V	03	50	-	03	50
2	Paper-VI	03	50	-	03	50
	Semester-IV					
3	Paper-VII	03	50	-	03	50
4	Paper-VIII	03	50	-	03	50
	Practical- I (annual)	-	-	04	04	50
	Practical- II (annual)	-	-	04	04	50
	Total	06	-	08	14	**300**

12. SCHEME OF EXAMINATION :-

- The examination shall be conducted at the end of each term for semester pattern.
- The Theory paper shall carry 50 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of Semester Examination of 50marks.
- Question Paper will be set in the view of the /in accordance with the entire Syllabus and preferably covering each unit of syllabi.

13. STANDARD OF PASSING:-

As Prescribed under rules & regulation for each degree.

14. NATURE OF QUESTION PAPER AND SCHEME OF MARKING:

Common Nature of Question shall be applicable as per Faculty of Science

15. EQUIVALENCE IN ACCORDANCE WITH TITLES AND CONTENTS OF PAPERS- (FOR REVISED SYLLABUS)
(Introduced from June 2014 onwards)

Old Syllabus (Semester pattern)		Revised Syllabus (Semester pattern)		
Paper No.	**Title of Old Paper**	**Semester No**	**Paper No.**	**Title of New Paper**
V	**Plant Physiology**	**Semester- III**	**V**	**Algae, Fungi, Bryophytes and industrial applications**
VI	**Utilization of Plants**		**VI**	**Plant Physiology, Ecology and Horticulture**
VII	**Plant Ecology**	**Semester- IV**	**VII**	**Pteridophytes, Gymnosperms, Angiosperms and Anatomy**
VIII	**Development of Plants**		**VIII**	**Cytogenetics and Utilization of Plant Resources**

16. SPECIAL INSTRUCTIONS, IF ANY.

B.Sc. Part II Botany
SEMESTER III
Paper- V
Algae, Fungi, Bryophytes and Industrial Applications

(40 Periods)

Unit-1. Algae : 12

Sub-unit 1.1: Study of life cycle with respect to taxonomic position, occurrence, thallus structure, reproduction (excluding developmental stages of sex organs) of the following types-

a) *Oedogonium* (Chlorophyceae)

b) *Sargassum* – (Phaeophyceae)

Unit- 2. Fungi : 14

Sub-unit 2.1: Study of following types with respect to taxonomic position, occurrence, structure of mycelium, nutrition and reproduction (excluding developmental stages of sex organs) in

a) *Penicillium* (Ascomycotina**)**

b) *Puccinia*- (Basidiomycotina)

Sub-unit 2.2 Lichen: Introduction, Nature of association of phycobionts and mycobionts, Types of lichen and Economic importance.

Unit- 3. Bryophytes: 06

Sub-unit 3.1: Study of life cycle with respect to taxonomic position, occurrence, thallus structure, reproduction (excluding developmental stages of sex organs) of the following type-

a) *Anthoceros*- (Anthocerotopsida)

Unit- 4. Industrial applications: 08

Sub-unit 4.1: Mushroom cultivation: Introduction, Steps in cultivation of Pleurotus (Sajor kaju), Value added products, commercial importance of mushrooms.

Sub-unit 4.2: Bio-fertilizers: Introduction, definition, Types of biofertilizers,

Nitrogen fixing biofertilizers- Bacteria- *Rhizobium*, Fungi-*Trichoderma*, Blue green algae- *Nostoc*, and *Anabaena* associated with *Azolla*, Phosphate solubilising biofertilizers, Commercial importance of biofertilizers.

B.Sc. Part II Botany
SEMESTER III
Paper- VI
Plant Physiology, Ecology and Horticulture

(40 Periods)

Unit 1. Plant growth and Development **16**

Sub Unit 1.1: **Plant growth –**Introduction and definition, Phases of growth, Growth curve and grand period of growth.

Sub Unit 1.2: **Plant growth regulators –**Introduction ,definition and Practical applications of – i) Auxins, ii) Gibberellins, iii) Cytokinins, iv) Abscisic acid, v) Ethylene

Sub Unit 1.3: **Physiology of flowering** –

Introduction, Photoperiodism – Concept, definition, Short Day Plants, Long Day Plants and Day Neutral Plants, Photoperiodic induction, phytochromes and flowering. Floregin concept and role of hormone in flowering.

Sub Unit 1.4: **Vernalization** – Introduction and applications of vernalization.

Sub Unit 1.5: **Seed dormancy -** Seed dormancy-Introduction, Causes of seed dormancy, Methods of breaking of seed dormancy

Unit 2. Plant Indicators and Phytogeography. **04**

Sub Unit 2.1: Plant as indicators.

Sub Unit 2.2: Role of indicators in environmental monitoring.

Sub Unit 2.3: Phytogeography-General Principles and objectives. Phytogeographical regions of India(As per Chatterjee and Mani).

Unit-3. Ecological succession and Plant adaptations **08**

Sub Unit 3.1 Introduction and Definition

Sub Unit 3.2 Primary and secondary succession

Sub Unit 3.3 Hydrosere and Xerosere

Sub Unit 3.4 Xeric, Hydric and Mesic adaptations.

Unit- 4. Horticulture: **12**

Sub Unit 4.1 Scope **and Branches of Horticulture**

Definition and description of the Following branches

1 Pomoculture 2 Olericulture 3 Floriculture

4 Ornamental and landscape gardening

Sub Unit 4.2 **Propagation of horticultural plants.**

a) Sexual methods (seed propagation) – Definition, Merits and Demerits, Criteria for selection of seeds.

b) Asexual (Vegetative) propagation – Definition,

Types- Cutting (root, stem, leaf), Layering (simple, air), Grafting (Whip, Approach) and Budding(T, patch).

B.Sc. Part II Botany
SEMESTER IV
Paper- VII
Pteridophytes, Gymnosperms, Angiosperms and Anatomy

(40 Periods)

Unit 1. Pteridophytes: 08

Sub-unit 1 .1 Study of life cycle with respect to taxonomic position, occurrence, morphology, anatomy and reproduction (excluding developmental stages of sex organs) of the following types-

a) *Psilotum* (Psilopsida)

b) *Equisetum (Sphenopsida)*

Unit 2. Gymnosperms: 08

Sub-unit 2 .1 Study of life cycle with respect to taxonomic position, occurrence, morphology, anatomy and reproduction (excluding developmental stages of sex organs) of the following type-

a) *Pinus* (Coniferopsida)

Unit 3. Angiosperms: 12

Subunit 3.1. General account of morphology of Inflorescence, Flower and Fruits

Subunit 3.2. Broad outline of Bentham and Hooker system of classification (upto series), Merits and demerits.

Sub-unit 3.3. Botanical gardens- Introduction, role and significance, Botanical gardens in India- (Indian Botanical Garden, Calcutta; National Botanic Garden, Lucknow, Lead Botanical Garden, Shivaji University, Kolhapur).

Unit 4 . Plant Anatomy: 12

Sub -unit 4.1 Primary structure of Monocotyledon and Dicotyledon root, stem and leaves.

Sub- unit 4.2 Normal Secondary growth in Dicotyledon root and stem.

Sub-unit 4.3 Periderm and lenticel.

Sub-unit 4.4 Anomalous secondary growth-

a) Anomalous secondary growth of stem of *Bignonia*..

b)Anomalous secondary growth of stem of *Dracaena*.

B.Sc. Part II Botany
SEMESTER IV
Paper- VIII
Cytogenetics and Utilization of Plant Resources

(40 Periods)

Unit 1 - Nucleus and Ribosomes. 10

Sub-unit 1.1 Ultra structure, nuclear envelope, nuclear pore complex, nuclear matrix and nucleoplasm.

Sub-unit 1.2 DNA and histones, nucleosome and higher level of organization. Role of telomere.

Sub-unit 1.3 Structure of prokaryotic and eukaryotic ribosomes and their functional significance.

Unit 2 - Sub-cellular structures and Cell Membrane. 10

Sub-unit 2.1 Golgi complex.

Sub-unit 2.2 Endoplasmic Reticulum.

Sub-unit 2.3 Lysosomes.

Sub-unit 2.4 Microbodies - Peroxisomes and glyoxysomes

Sub-unit 2.5 Cell membrane: Structure, Model of cell membrane organization-Fluid Mosaic.

Unit 3 - Linkage and Recombination **08**

Sub-unit 3.1 Linkage--a) Introduction

b) Linkage groups, Linkage phases-Coupling and Repulsion , Types-Complete and incomplete Linkages, significance.

Sub-unit 3.2 Recombination (Crossing over)—

a) Introduction b) Mechanism of crossing over.

c) Cytological Proof for recombination

d) Crossing over a measure of genetic distance, significance.

Unit 4- Utilization of Plant Resources **12**

Sub Unit 4.1 Natural products:

a) Rubber: Plant source and economic importance

b) Plant insecticides: Botanical name, morphology, sources and uses of – *Azadirechta indica*, and *Nicotiana tabacum.*

c) Dyes: Botanical name, morphology, sources and uses of – *Curcuma longa*, *Bixa orellana*, *Butea monosperma*.

Sub Unit 4.2 **Medicinal plants:**

A brief account of following medicinal plants and their chief constituents used in indigenous and allopathic system and their uses.

a) Root : *Withania somnifera,*

b) Rhizome : *Zingiber officinale,.*

c) Stem : *Tinospora cordifolia.*

d) Leaf : *Justicea adathoda,*

e) Flower bud : *Syzygium aromaticum.*

F) Fruit : *Emblica officinalis.*

Details of Practical Examination

A) Every candidate must produce a certificate from Head of the Dept. in his /her college, stating that he / she has completed practical course in satisfactory manner as per guidelines laid down by Academic Council on the recommendations of Board of Studies in Botany. The student should record his / her observations and report of each experiment should be written in the journal. The journal is to be signed periodically by teacher in charge and certified by the Head of the Department at the end of year. Candidates have to produce their certificated journal and tour report at the time of practical examination. Candidate is not "allowed to appear" for the practical examination without a certified journal / a certificate from Head of the Botany Dept. regarding the same.

B) Practical Examination shall be of Five hours duration and shall test a candidate in respect of the following.

1. Practical study of external and internal structures of different plant types and their classification. Making temporary stained preparations and identification.
2. Identification and setting of physiological and biochemical experiments.
3. Study of plant families as per syllabus.
4. Spotting of the specimens as per syllabus.

Botanical Excursions

One teacher along with a batch not more than 20 students be taken for botanical excursion to places of Botanical interest, one in each term. If there are female students in a batch of twenty students, one additional lady teacher is permissible for excursion. Each excursion will not be more than three days during college working days. T.A. and D.A. for teachers and non-teaching staff participating in excursions should be paid as per rules. Tour report duly certified by teacher concerned and Head of the Department should be submitted at the time of practical examination.

Practical Course

B. Sc. II Botany Practical course is to be covered in fifty one practicals. These practicals are to be performed by the students. Each practical is to be supplemented by permanent slides, preserved / fresh specimens / materials, charts, herbarium sheets, etc. wherever necessary.

List of Practical's

Practical-I (Based on Paper No. V and VII)

1) Study of *Oedogonium*

2) Study of *Sargassum*.

3) Study of Penicillium

4) Study of *Puccinia*.

5) Study of Lichen types (Morphology)

6) Study of *Anthoceros*

7) Demonstration of mushroom cultivation

8) Study of biofertilizers.(root nodule, *Azolla, Trichoderma, Nostoc* balls)

9) Study of *Psilotum*.(By permanent Slides)

10) Study of *Equisetum*

11) Study of *Pinus*

12& 13) Study of Morphology and Modifications of Inflorescence.

14& 15) Study of Morphology and Modifications of Flowers.

16& 17) Study of Morphology and Modifications of Fruits.

18) Double stained permanent micro-preparation technique.

19) Study of normal secondary growth in Dicotyledon stem and root.

20) Study of anomalous secondary growth in Bignonia stem and Dracaena stem.

21) Study of wood anatomy- porous and non-porous wood.

22to 25) Study of morphological and reproductive characters in families-

a) Caesalpinaceae

b) Solanaceae

c) Nyctaginaceae

d) Amarylidaceae.

Practical –I
Skeleton Paper:

Q. 1. Observe the important structures in specimens **A, B** and **C.** (Algae, Fungi, Bryophyte/ Pteridophytes). 12
Q. 2. Observe the important structures in specimens **D. (**Gymnosperm). 03
Q. 3. Identify and classify the family- Give Morphological and reproductive characters. 06
Q. 4. Make a permanent double stained micro-preparation of given specimen **E** 09
Q. 5. Identification- (5 spots) 10

a) Identify and describe Inflorescence-F.
b) Identify and describe Flower.-G
c) Identify and describe Fruit.-H
d) Identify and comment Lichen-I
e) Identify and comment biofertilizer / Mushroom cultivation-J

Q.6. a) Journal 05
b) Horticulture term paper. 05

Total 50

Practical-II (Based on Paper No. VI and VIII)

1) To study the permeability of plasma membrane using any **two** different concentrations of organic solvents.
2) Analysis of vegetative growth
3) Breaking of seed dormancy by Mechanical and chemical methods.
4) Bioassay of Auxin (IAA)
5) Bioassay of Gibberellic acid
6) Bioassay of Cytokinin
7) Demonstration of technique of budding (patch and T)
8) Demonstration of technique of grafting (whip)
9) Demonstration of technique of layering. (air layering)
10) Study of meteorological instruments.
11) Determination of density, abundance and frequency of different species in quadrat (List quadrat)
12) Ecological adaptations in morphology and anatomy of hydrophytes. (Hydrilla, Eichhornia and Typha)
13) Ecological adaptations in morphology and anatomy of xerophytes (Aloe, Nerium)
14) Ecological adaptations in morphology and anatomy of epiphytes and parasites (Aerides and Cuscuta)
15) To study phytogeographical regions of India
16) To prepare ecological tour report of any locality of botanical interest.
17) Determination of water holding capacity of two different soil samples.
18) Genetics examples- Linkage
19) Genetics examples- Crossing over
20) Study of rubber yielding plants (As per theory)
21) Study of plant insecticides- sources (As per theory)
22) Study of sources of dyes (As per theory)
23) Study of plants used as resources of drugs. (As per theory)
24) Visit to nursery/green house/poly house/botanical garden.

Practical –II
Skeleton Paper:

Q. 1.Set up the Physiology experiment assigned to you and record your observations, submit the report to the examiner. 06

Q. 2. Prepare the list quadrat of the marked area and find out the percentage frequency/ density of different species therein 06

Q. 3. Solve the given problem on Linkage and crossing over 06

Q. 4. Demonstrate the technique of budding/grafting/layering

OR

Describe the ecological adaptations (Hydrophytes or Xerophytes) 06

Q. 5. Identify, give the botanical names, plant part/parts, used and uses of specimens (medicinal plants) 06

Q. 6. Identification- (5 spots) 10

a) Identify and comment (Physiology experiment)

b) Identify and comment (Physiology experiment)

c) Identify and comment on-

(Meteorological instruments/ phytogeographical regions of India)

d) Identify and comment on- (Utilization of plants Rubber, Insecticides)

e) Identify and comment on- (Utilization of plants Dyes)

Q.7. a) Journal 05

b) Ecological tour report 05

(iii) Specific Objectives:----------

(iv) A brief note :- (On expected level of study from examination and assessment point of view):- -----

(v) Recommended Reading :
(In MLA/APA Style Sheet Format)

a) Basic Reading :-

b) Additional Reading :-

c) References :-

d) Books

List. of Books Recommended for B. Sc. II Botany

Algae –

1. Introductory Phycology. H. D. Kumar, 1988, Affiliated East-West Press Ltd., New York.
2. Algae - H. D. Kumar and H. N. Singh (1991)
3. Algae - O. P. Sharma (1986)
4. Algae - B. P. Pandey (1994)
5. A Text book of Algae - G. L. Chopra (1969)
6. A Text book of Algae - H. D. Kumar and H. N. Singh (1977)
7. A Text book of Botany - V. Singh, P. C. Pandey, D. K. Jain (1999)
8. A Text book of Botany Vol. I – S. N. Pandey, S. P. Misra and P. S. Trivedi (1.982)
9. A Treatise on Algae - K. N. Bhatia (1980)

Fungi –

1. A Hand book of Lichens - D. D. Awasthi (2000)
2. An Introduction to Fungi - H. C. Dube (1990)
3. Morphology of Plants and Fungi -- H.C. Blod, Aloxopoulos, G. J. and Delevoryas, T. 1980. (4th Edition) Harper and Foul Co., New York.
4. An Introduction to Fungi.-- H. C. Dube, 1990. Vikas Publishing House Pvt. Ltd., Delhi.
5. Cryptogamic Botany Vol. I & II (2nd Edition), M. S. Gilbert, 1985. Tata Mcgraw Hill Publishing Co., Ltd New Delhi.
6. Fungi- B. R. Vashishtha (1996)
7. Fungi- B. P. Pandey (1994)
8. Introduction to Fungi - Sundrarajan (2001)
9. Introductory Mycology - C. J. Alexopoulos, C. W. Mims, M. Blackwell
10. Cryptogamic Botany Vol. I - Algae and Fungi - G. M. Smith (1974)
11. Hand BooK of Organic Farming and Biofertilizers- M. K. Gupta ; ABD Publisher, Jaipur India- 2007.
12. Mushroom - Cultivation, Processing and Uses- B. C. Saman and V. P. Sharma- Agrobios India- 2005.

Bryophytes –

1. Bryophytes. P. Puri, 1985. Amarm & Sons, Delhi.
2. College Botany - S. Sundararajan (1999)
3. College Botany Vol. I - H. C. Gangulee, Das K. S. and Datta C. T. (1991)
4. College Botany Vol. II - H. C. Gangulee and Kar A. K. (1999)
5. College Botany Vol. III -- S. K. Mukharji (1990)
6. Cryptogamic Botany Vol. I- G. M. Smith (1955)
7. Cryptogamic Botany: Bryophytes and Pteridophytes - G. C. Smith (1955)

Pteridophytes—

1. An Introduction to Pteridophytes - A. Rashid (1978)
2. An Introduction to Pteridophyta (Diversity and Differentiation) -A. Rashid (1976)
3. A Text book of Pteridophyte – S. N. Pandey, P. S. Trivedi, S. P. Misra (1995)
4. An Introduction to Embryophyta - N. S. Parihar (1961)
5. Morphology and Evolution of Vascular Plants- E. M. Gifford and A. S. Foster, 1989. W.H. Freeman & Co., New York.
6. Morphology of vascular Plant (lower groups) -- A. J. Eames.
7. Illustrated Manual of Ferns of Assam -S. K. Borthakur, P. Deka, K. K. Nath (2000)
8. Pteridophyta – Vascular Cryptogams - P. C. Vashishta (1972)
9. Botany for Degree Students- Pteridophyta (Vascular Cryptogams) - P. C. Vashishta, A. K. Sinha, Anil Kumar – S Chad – Multicolour Illustrative Revised Edition- 2006.

Gymnosperms –

1. Botany for Degree Students- Gymnosperms (Vascular Cryptogams) - P. C. Vashishta, A. K. Sinha, Anil Kumar – S Chad – Multicolour Illustrative Revised Edition- 2006.
2. The Moropology of Gymmosperms. -- K. R. Sporne, 1991. B. I. Publications Pvt., Bombay, Calcutta, Delhi.
3. Morphology of Gymnosperms -- J. M. Coulter and C. J. Chamberlain.
4. Gymnosperms – Structure & Evolution.-- C. J. Chamberlain
5. Morphology of Gymnosperms.-- K. R. Sporne.
6. Gymnosperms- P. C. Vashishta (1976)
7. Gymnosperms- C. J. Chamberlein (1966)
8. Indian Gymnosperms in Time and Space - C. G. K Ramanujan. (1979)
9. Origin and Evolution of Gymnosperms - Ed Charles B. Beck (2002)
10. Phylogeny and form in the plant Kingdom - H. C. Dittmer (1964)

Angiosperms ---

1. Principles of Angiosperm Taxonomy – P. H. Davis, Heywood V. M. (1963)
2. The evolution and classification of flowering plants. – A. Cronquist, 1968. Thomas Nelson (Printers) Ltd., London & Edinburgh.
3. Plant Diversification. --Delevoryas, Th. 1965 Modern Biology Series, Half Rinehart &Winston, New York.
4. Comparative Morphology of Vascular Plants. - A. S. Foster and Gifford, A.E.M. jr. 1967. Vakils, Peffer & Simons Pvt., Ltd.
5. The Morphology of Angiosperms. -- K.R Sporne, 1977. B.I. Publication, Bombay.
6. The Embryology of Angiosperms. -- S.S. Bhojwani and Bhatnagar, S.P. 2000. 4th revised and enlarged edition. Vikas Publishing House, Delhi.

7. Embryology of Angiosperms. -- B.M. Johri, 1984. Springer-Verlag Berlin.
8. Molecular Embryology of Flowering Plants. -- V. Raghvan, 1997. Cambridge University Press New York.
9. Principles of Angiosperm Taxonomy. -- P.H. Davis and V.H. Haywood, 1963. Oliver and Royd, London.
10. Current Concepts in Plant Taxonomy. -- V.H. Heywood and D.M. Moore 1984. Academic Press, London.
11. Plant Systematics (2nd edition). -- Jones, S.B. Jr. and Luchsinger, A.E. 1986. McGraw-Hill Book Co., New York.
12. Taxonomy of Vascular Plants. -- G.H.M. Lawrance, 1951. MacMillan, New York.
13. Taxonomy of Angiosperms. -- V.N. Naik, 1984. Tata McGraw Hill, New York.
14. Fundamentals of Plant Systematics -- A.E. Radford, 1986. Harper and Row, New York..
15. Plant Systematics: Theory and practice -- G. Singh, 1999. Oxford & IBH Pvt., Ltd. New Delhi.
16. An Introduction to Plant Taxonomy. -- C. Jeffrey, 1982. Cambridge University Press, Cambridge London.
17. Plant Taxonomy and Biosystematics. -- C.A. Stace, 1989. 2nd ed. Edward Arnold, London.
18. Contemporary Plant Systematics. -- D.E. Woodland. 1991. Prentice Hall, New Jersay.
19. Plant Systematics for 21st Century -- B. Nordenstam, El-Gazaly, G. and Kassas. M. 2000. Portland Press Ltd., London.-
20. Embryogenesis in Angiosperms: A Development and Experimental Study.-- V. Raghavan. Cambridge University Press New York. USA. 1986.
21. The flora of the Presidency of Bombay Volume- I, II & III. -- T. Cooke. (1958) Bishen Singh, Mahendra Pal Singh, Dehradun.
22. Taxonomy of the Angiosperms -- A. J. Eames.
23. Text book of systematic botany. -- R. N. Sutaria.
24. Methods of Descriptive systematic Botany -- A. S. Hitchcock.
25. Flora of Khandala -- H. Santapaun.
26. An Introduction to Embryology of Angiosperms. -- P. Maheshwari.
27. Endemic plants of India - M. Ahmeduilah & Nayar M. P.
28. Biodiversity in India – Floristic aspects -- R. R. Rao – 1995

Anatomy--

1. An Introduction to plant Anatomy -- A. J. Eames and M. C. Danialls.
2. Plant Anatomy. -- G. Haberland

Ecology --

1. A Text Book of Plant Ecology. -- R.S. Ambasht. 1988 Students Friends Co. Varanasi.
2. Plant Ecology-- J. E. Weaver and F. E. Clements. 1966. Tata McGraw Publishing Co. Ltd. Bombay.
3. Ecology: Principles and Applications - J.L. Chapman and M.J. Reiss, 1995. Cambridge University Press.
4. Methods in Plant Ecology.-- P. W. Moore and S. B. Chapman, 1986. Blackwell Scientific Publication.
5. Fundamentals of Ecology. -- M.C. Dash, 1993. Tata McGraw Hill Publishing Co. ltd., New

Delhi.
6. Plants and Environment- A Text Book of Plant Ecology – R.F. Daubenmire, 1974. (3rd edition). John Wiley & Sons. New York.
7. Elements of Ecology. -- L.R. Smith and T.M. Mith, 1998. (4th edition). An imprint of Addison Wesley, Longman ink., California.
8. Modern Concepts of Ecology (3rd edition). -- H.D. Kumar,1996. Vikas Publishing House Pvt., Ltd. Delhi.
9. General Ecology. -- H.D. Kumar, 1997. Vikas Publishing House Pvt. Ltd., Delhi.
10. Concepts of Ecology.-- .F.J. Kermondy,1996. Prentice Hall of India Pvt. Ltd., New Delhi.
11. Soils-An Introduction to Soil and Plant Growth-- W.R. Miller and Donahue.R.L. 1992. (6th edition). Prentice Hall of India Pvt. Ltd., New Delhil.
12. Fundamentals of Ecology.-- E.P. Odum, 1996. Natraj Publishing, Dehradun.
13. Hot Spots of Endemic Plants of India Burma & Nepal-- M.P. Nayar 1996.
14. Ecology and Field Biology -- L.R. Smith. 1996. (5th edition). Harper Collns College Publishers, USA.
15. Environment and Pollution-- R. S. Ambasht. 1990. Students Friends and Co. Varanasi, India.
16. Experimental Plant Ecology-- P. Kapur and S. R. Govil, 2000. S.K. Jain for CBS Publishers and Distributors, New Delhi.
17. Ecology Work Book.-- R. Misra 1968. Oxiord and IBH, New Delhi.
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10. W.S. Hiiman --The Physiology of flowering.
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3. Cell Biology, Genetics, Evolution and Ecology – P S. Verma, V K. Agarwal (2001)
4. Cell Biology - R. Dowben (1971)
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7. Cell Physiology - A C. Giese (1979)
8. Cellular Energy Metabolism and Its Regulation - Atkinson, D. E. (1977)
9. Genetics - P. K Gupta (1997) Rastogi Publications. Shivaji Road, Meerut.
10. Gene Action - Hartman alld Suskind (1968)
11. Cytology and Genetics.-- Dnyansagar (T. Magrewith & Co.)
12. Plant Chromosomes: Laboratory Methods -- Fukui. K. and Nakayama S. 1996. CRC Press, Boca Raton, Florida.
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19. Genetics: Principles and Analysis-- Hartl.D.L. and Jones.E.W. 1998. (4^{th} Edition) Jones & Barlett Publishers. Massachusetts. USA.
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21. Molecular Biology of Cell. Alberts B., Bray D., Lewis, J., Raff, M. Roberts, K. and Wastson, J.D. 1999.Garland Publishing Co., Inc., New York USA.

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1. Kocchar, S. L. 1998. Economic Botany in Tropics, 2nd edition. Macmillan India Ltd., New Delhi.
2. A Textbook of Economic Botany-- Sambamurthy, A. V. S. S. and Subramanyam, N. S. 1989. Wiley Eastern Ltd., New Delhi.
3. Hill's Economic Botany. -- Sharma, O. P. 1996. Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Economic Botany - Plants in Our World. Simpson, B. B. and Conner-Ogorzaly, M. 1986. McGraw Hill, New York.

Horticulture:

I. Gardening in India. -- Perey Lancaster (1997) Oxford & I B H Publishing Co.Pvt.Ltd, New Delhi.

2. Floriculture: Fundamentals & Practices. - Alex Laurie and Ries V.C. (2003)
3. Percy Lancaster's Gardening in India.- Bose, T.K. and Mukherjee, D. (1997) (Ed.) Oxford and IBH Publ. (P.) Ltd,, New Delhi, India.
4. A Art of Miniature Plant Culture. - Day, S.C. (2003)Agrobias. Jodhpur, India.
5. Complete Home Gardening. -Dej, S.C. (2003) Agrobias, Jodhpur, India.
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7. Horticulture and Gardening.- Khan, M.R. (1995) Nirali Prakashan, Pune. India.
8. Gardening for every one- Pramila Mehra. Hind pocket book private limited, New Dehli.
9. Hand Book of the Multiplication of Plants- L. H. Bailey; Discovery Publishing House, New Delhi-1993.
10. Fundamentals of Horticulture- J. B. Edmond, T. L. Senn, F. S. Andrews, R. G. Halfacre; Tata Mc-Grew Hill Publishing Company Ltd, New Delhi- 1995.
11. Wonderworld of Tropical Bonsai- Jyoti and Nikunj Parekh; Vakils, Feffer and Simons Ltd, Bombay-1993.
12. Practical Gardening in India- R. Barton West; Discovery Publishing House, New Delhi-1999.
13. Everyday Gardening in India- E. W. Grindal; D. B. Taraporevala Son and Company Private Ltd. Bombay-1960.
14. Encyclopedia of Practical Horticulture vol. I to IV- V. K. Sharma; Deep and Deep Publications Private Ltd, New Delhi- 1999.
15. Flowering Trees- M. S. Randhawa; National Book Trust India- 1996.
16. Indian vegetable Garden- Including a cultivation of flowering annuals- N. Gill; Shree Publishing House, Ajmari Gate, Delhi-1985.
17. Garden Flowers- Dr. Vishnu Swarup; National Book Trust India- 1967.
18. Complete gardening in India- Gopal Swami Inygar
19. Floriculture in India- Gurcharan Singh Randhawa and Amitabha Mukhopadhyay, Allied Publishers.

C] OTHER FEATURES:

1. INTAKE CAPACITY / NUMBER OF STUDENTS:-

As per university rules.

2. TEACHERS QUALIFICATIONS:-

- As prescribed by norms.
- However required number of core faculty should be given for particular course along with paper wise and Specialization wise work load allocation.
- Work load details should be as per Apex body/UGC/State Govt./University norms.

LIBRARY: Library be equipped with the required Reference and Text Books, Journals and Periodicals for higher and advanced studies as per stated in revised syllabus and approved by BOS.

SPECIFIC EQUIPMENTS:

T.V., V.C.R. V.C.P., L.C.D., Overhead Projector, Computers and necessary software and operating systems etc. are necessary to run the course.

LABORATORY SAFETY EQUIPMENTS:

i) Fire extinguishers at least two sets in each laboratory of 600 sq.ft. Area.

ii) Leakage of gases be avoided.

iii) First aid kit be made available.

iv) Sugar / Glucose –500gm pack- a pinch of sugar and a cup of drinking water in hypoglycemic condition or in extreme weakness of student or a person concerned

B) GENERAL SAFETY RULES FOR LABORATORY WORK

1) List of equipments needed for Laboratory Safety:-

1. Fire extinguisher
2. First Aid Kit
3. Good earthing and insulated wirings for electrical supply.
4. Emergency exit
5. Apron and goggles wherever necessary
6. Fuming Chambers
7. Masks flows and shoes while handling hazardous chemicals & gases (Good valves, manometers and regulators for gas supply)
8. Operational manuals for instruments (handling to be made as suggested.)
9. Rules of animals and blanks ethics.
10. Leakage of gases to be avoided.
11. Cylinders or flow pipes to handle Acids.
12. No weighings for NaOH and hygroscopic substances.
13. Stabilized supply in the laboratory.

2) There Is No Substitute for Safety

1. Any injury no matter how small, it must be reported to teacher immediately.
2. a) In case any chemical enters your eyes go immediately to eye- wash facility and flush your eyes and face with large amount of water.

b) For acid or phenol split, do not use water instead put some bicarbonate.

3. In case of fire, immediately switch of all gas connections in the laboratory and pour sand on the source of fire or cover it with asbestos or cement sheet.
4. While leaving laboratory, make sure that gas, water taps and electricity are switched off.
5. Remove your lab coat. Gloves and clean your hands before leaving laboratory.
6. Make your workplace clean before leaving the laboratory.
7. Keep your hands away from your face, while working in laboratory.
8. Each laboratory must have a first aid box.
9. Know what to do in case of emergency - e.g.

   (a) Know the place of fire extinguisher and first aid box.
10. Don't use cell phones in the laboratory.

    (a) Remember important phone numbers

3) DO's

1. Always wear lab coat, shoes in the laboratory. Every student must have their weight box, a napkin etc.
2. Maintain separate record book for each subject.
3. Keep your belongings at the place allotted for the same.
4. Maintain silence, order, cleanliness and discipline in the laboratory.
5. Work at the place allotted to you or specially used for certain operations.
6. Keep the working table clean.
7. Handle the laboratory equipments, glassware and chemical with great care.
8. Use only required quantities of material and apparatus of essential size.
9. Perform the test in their proper order.
10. Know the location of eye wash fountain and water shower.
11. Minimize your exposure to organic solvents.
12. The Metal like sodium should be kept under kerosene or liquid paraffin layer in a vessel with a cork stopper.
13. Sodium metal should be cut on dry filter paper. The cut off pieces of sodium should be immediately collected in a vessel containing kerosene or liquid paraffin.
14. Always pour acid into water when diluting and stir slightly.
15. All operations involving poisonous flammable gases and vapours should be carried out in the flame chamber (with exhaust facility)
16. Ladies should avoid wearing saree. If it is there, apron is essential.

4) DON'T

1. Don’t work alone in the laboratory
2. Don’t leave the glass wares unwashed.
3. Don’t take apparatus, chemicals out of lab.
4. Don’t leave any substance in a vessel or bottle without label.
5. Don’t weigh the reagent directly on the balance pan.
6. Don’t throw the cut off pieces of sodium metal in sink or water. Transfer it immediately in its container.
7. Don’t take sodium metal with hands. Use forceps.
8. Don’t panic and run in case of fire. Use the fire extinguishers or sand buckets.
9. Don’t breathe the vapours of organic solvents.
10. Don’t pour any unused reagent back in its stock bottle.
11. Don’t eat or drink any food in laboratory.
12. Don’t use inflammable solvents like benzene, ether, chloroform, acetone and alcohol around flame.
13. Don’t distill to dryness.
14. Don’t exchange stoppers of flasks and bottles containing different reagents.
15. Don’t leave reagent bottle lying on the table.
16. Don’t disturb the order of reagent bottles in which they are placed.
17. Don’t bring reagent on your working table from the general shelf.
18. Don’t throw burning matchstick into dustbin.
19. Don’t leave the laboratory without permission.

5) LABORATORY / FIELD WORK CARE AND SAFTY FOR BOTANY STUDENTS

1. Unnecessary wastage of plant material during practicals should be avoided.
2. During study tour / personal collection/field work, more emphasis be given on study of plants in nature and collection of wild plants, rare plants, should not be carried out.
3. If at all the collection of the plant material in needed, it should be carried out under supervision of concerned teacher. Collection of poisonous plants / poisonous mushrooms should be avoided.
4. Oral intake of unknown plant material, out of curiosity, during practical or collection tour is strictly prohibited.
5. If there is any allergic reaction while handling the plants / plant parts / pollen grains / fungal specimens it should be immediately brought to the notice of the concerned teacher and reported to the registered medical purloiner.

6. Wearing of hand gloves (and mask) is essential while handling poisonous plants / herbarium sheets / toxic and hazardous chemicals / reagents / strong acids / strong alkalis during the experiment should be made with vacuum pipette / auto pipette / burette under the supervision of concerned teacher / lab assistant.

7. Highly inflammable organic solvents (alcohol, acetone etc.) should not be kept in vicinity of spirit lamp.

8. The laboratory safety measures adopted for handling of hazardous chemicals in chemistry practicals should be followed for conducting practicals in plant biochemistry / microbiology.

9. Operational manuals for equipments such or centrifuge, autoclave, spectrophotometer should be followed.

10. In case of minor injuries, preliminary treatment should be undertaken with the help of first aid kit available in the laboratory. In case of serious injury, concerned teacher should be immediately contacted for consultation to the physician.

11. The instruction report for breeding, experimentation will be submitted in a week period. (Which are laid down by Ministry of Social Justice & Empowerment and Ministry of Environment and Forests, Govt. of India).

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