

SHIVAJI UNIVERSITY, KOLHAPUR.



B

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(2009)

New/Revised Syllabus For

Bachelor of Science

B. Sc. Part I (Botany)

Paper I, II, III, IV Sem. I and II

Syllabus to be implemented from June 2013 onwards.

A] **Ordinance and Regulations:-**
(as applicable to degree/programme)

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

1. TITLE : Subject – Botany
Optional /Compulsory/Additional/IDS under the Faculty of Science

2. YEAR OF IMPLEMENTATION:- New Syllabus will be implemented from June 2013 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/ PAPER/ :

(as applicable to the Degree /Subject- Paper concerned)

1)

2)

3)

4)

5)

5. DURATION

- **The course shall be a full time course.**
- **The duration of course shall be of Three years, as applicable to the respective degree.**

6. PATTERN:-

Pattern of Examination will be Semester.

7. FEE STRUCTURE :- As per Government /University rules

[Note :- In case of any New degree/Programme started at university/college, the respective colleges/ Dept. should submit a separate proposal of fee structure to BOS office. (i. e. Tution Fee & Laboratory Fee, if any.)]

9. ELIGIBILITY FOR ADMISSION :-

As per eligibility criteria prescribed for respective degree programme and the merit in the qualifying (i.e. Entrance Examination) examination, if any.

10. MEDIUM OF INSTRUCTION :

The medium of instruction shall be in English.

11. STRUCTURE OF COURSE: -----

(Note – The structure & title of papers of the degree as a whole should be submitted at the time of submission/revision of first year syllabus.)

FIRST YEAR (SEMESTER I/II) (NO.OF PAPERS- 4)

Sr.No.	Subjects/Papers	Theory	Internal	Total Marks
1.	Diversity in Non vascular Plants	50	--	50
2.	Plant Biochemistry, Physiology and Ecology	50	--	50
3.	Diversity in Vascular Plants	50	--	50
4.	Cytology, Genetics and Utilization of Plants	50	--	50
5.	Practical	50	--	50
	Total			250

12. SCHEME OF TEACHING AND EXAMINATION:-

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

FIRST YEAR / SEMESTER – I/ II

Sr. No.	Subject /Paper	Teaching Scheme (Hrs/Week)				Examination Scheme (Marks)		
		L	T	P	Total	Theory	Term Work	Total
1	Diversity in Non vascular Plants	2 ^{1/2}	--			50	--	50
2	Plant Biochemistry, Physiology and Ecology	2 ^{1/2}	--			50	--	50
3	Diversity in Vascular Plants	2 ^{1/2}	--			50	--	50
4	Cytology, Genetics and Utilization of Plants	2 ^{1/2}	--			50	--	50
5	Practical			4		50		50
	Total	05	--	04		250		250

SHIVAJI UNIVERSITY, KOLHAPUR

Proposed Syllabus of B. Sc.-I-BOTANY

(Semester pattern to be implemented from June-2013)

For each semester there will be two papers of 50 marks each.

The pattern of the papers will be as follow:

Semester I

Paper I : Diversity in Non vascular Plants

Paper II : Plant Biochemistry, Physiology and Ecology

Semester II

Paper III : Diversity in Vascular Plants

Paper IV : Cytology, Genetics and Utilization of Plants

Semester I

Paper – I : Diversity in Non Vascular Plants 40

Unit - 1 Basic concept of non vascular plants. 10

Sub-unit 1.1 Diversity – Concept and Importance.

Sub-unit 1.2 Diversity in non vascular plants with respect to a) Habitat b) Form
c) Nutrition and d) Ecological role.

Unit - 2 Algae 10

Sub-unit 2.1 General characters, classification (as per G.M. Smith) upto classes and economic importance.

Sub-unit 2.2 Important features and life history (excluding developmental stages) of following types :

- a) *Nostoc* (Myxophyceae)
- b) *Spirogyra* (Chlorophyceae)

Unit - 3 Fungi 10

Sub-unit 3.1 General characters, classification (as per Ainsworth) upto classes and economic importance.

Sub-unit 3.2 Important features and life history (excluding developmental stages) of the following types :

- a) *Mucor* (Zygomycotina)
- b) *Cercospora* (Deuteromycotina)

Unit - 4 Bryophytes 10

Sub-unit 4.1 General characters, classification (as per G.M.Smith) upto classes.

Sub-unit 4.2 Important features and life history (excluding developmental stages) of *Riccia* (Hepaticopsida)

Paper II - Plant Biochemistry, Physiology and Ecology	40
Unit 1 - Cell Biochemistry	10
Sub-unit 1.1 Cell as a biochemical entity	
Sub-unit 1.2 Covalent and non covalent interactions, electrostatic and hydrophobic interactions, Van-der Waal's forces and their significance.	
Sub-unit 1.3 Structure, properties and biological significance of water.	
Sub-unit 1.4 pH and Buffers -Significance of pH, pH scale, inorganic and organic buffers and their significance.	
Sub-unit 1.5 ATP- The energy currency.	
Unit 2 - Enzymes	12
Sub-unit 2.1 Introduction and Nomenclature.	
Sub-unit 2.2 Properties of enzymes	
Sub-unit 2.3 Classification of enzymes.	
Sub-unit 2.4 Mechanism of enzyme action.	
Sub-unit 2.5 Cofactors, coenzymes and isozymes.	
Sub-unit 2.6 Factors affecting enzyme activity - temperature and pH.	
Unit 3 – Plant Water Relations	10
Sub-unit 3.1 Water transport processes – Mechanism of water absorption [Active and Passive].	
Sub-unit 3.2 Ascent of sap – Transpiration pull theory.	
Sub-unit 3.3 Transpiration – Definition, Types, structure of stomata Mechanism of stomatal movement (Starch-sugar hypothesis), Significance.	
Sub-unit 3.4 Guttation and Wilting	
Unit 4. Ecology	08
Sub-unit 4.1 Introduction	
Sub-unit 4.2 Ecological factors – a) Climatic, b) Edaphic.	

Semester II

Paper III : Diversity in Vascular Plants	40
Unit: 1. Basic concept of vascular plants.	02
Sub-unit 1.1 Diversity with respect to a) Habitat b) Ecological role.	
Unit: 2. Pteridophytes	08
Sub-unit 2.1 General characters, classification (as per G.M. Smith) upto classes.	
Sub-unit 2.2 Important features and life history (excluding developmental stages) of <i>Selaginella</i> (Lycopsida)	
Sub-unit 2.3 Heterospory and seed habit.	
Unit: 3. Gymnosperms	08
Sub-unit 3.1 General characters, classification (according to Sporne, 1965) up to classes and economic importance	
Sub-unit 3.2 Important features and life history (excluding developmental stages) of <i>Cycas</i> (Cycadopsida).	
Unit : 4. Angiosperms	12
Sub-unit 4.1 General characters.	
Sub-unit 4.2 Importance and Functions of taxonomy.	
Sub-unit 4.3 Morphology of root, stem and leaf.	
Unit: 5. Anatomy	10
Sub-unit 5.1 Types of tissues	
a) Meristematic (Characterstics and Classification based on position)	
b) Permanent (Simple and Complex)	
Sub-unit 5.2 Types of vascular bundles.	

Paper IV : Cytology, Genetics and Utilization of Plants	40
Unit 1 - The Cell and Cell Division	10
Sub-unit 1.1 Characteristics of prokaryotic and eukaryotic cell.	
Sub-unit 1.2 Mechanism of Cell cycle.	
Sub-unit 1.3 Mitosis - Stages and significance.	
Sub-unit 1.4 Apoptosis.	
Unit 2. Mendelism	08
Sub-unit 2.1 Introduction and Basic terminology in genetics.	
Sub-unit 2.2 Mendel's laws of inheritance.	
Sub-unit 2.3 Back Cross and Test Cross	
Unit-3. Gene Interactions	06
Sub Unit 3.1 Introduction	
Sub Unit 3.2 Complementary and Supplementary genes interactions.	
Sub Unit 3.3 Dominant epistasis.	
Unit 4. Utilization of plants	16
Sub Unit 4.1 Introduction.	
Sub Unit 4.2 Cereals: Botanical name, morphology, sources and economic importance of Jowar (<i>Sorghum bicolor</i>), Wheat (<i>Triticum aestivum</i>).	
Sub Unit 4.3 Legumes: Botanical name, morphology, sources and economic importance of Chick pea (<i>Cicer arietinum</i>), Red gram (<i>Cajanus cajan</i>).	
Sub Unit 4.4 Oil crop: Botanical name, morphology, sources and economic importance of Sunflower (<i>Helianthus annuus</i>). Groundnut (<i>Arachis hypogaeae</i>)	
Sub Unit 4.5 Plant perfumes and cosmetics: Botanical name, morphology, sources and economic importance of – Rose (<i>Rosa indica</i>), Henna (<i>Lawsonia inermis</i>).	
Sub Unit 4.6 Ornamental plants: <i>Lagerstroemia reginae</i> , <i>Ixora chinensis</i> , <i>Dieffenbachia picta</i> , <i>Quisqualis indica</i> .	

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 certificate 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. I Botany Practical course is to be covered in twenty eight 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 wherever necessary.

List of Practical

Practicals based on Paper I and II of both the semesters.

- 1) **Bacterial types (P. S.)**
- 2) **Study of *Nostoc***
- 3) **Study of *Spirogyra***
- 4) **Study of *Mucor***
- 5) **Study of *Cercospora*.**
- 6) **Study of *Riccia*.**
- 7) **Study of *Selaginella*.**
- 8) **Study of *Cycas*.**
- 9 & 10) **Study of morphology and modifications of root.**
- 11 & 12) **Study of morphology and modifications of stem.**
- 13 & 14) **Study of morphology and modifications of leaf.**

- 15) Determination of soil pH (Any two samples).
- 16) Effect of pH on enzyme activity – / Dehydrogenase
- 17) Effect of temperature on enzyme activity – Catalase
- 18) Study of mitosis in onion root tips/ any other suitable plant material.
- 19) To study structure of stomata and to determine the stomatal density.
- 20) To study stomatal and cuticular transpiration
- 21) To study meristematic tissue – Root apex and Shoot apex (P. S.).
- 22) To study simple and complex tissue (P. S.).
- 23) To study types of vascular bundles (P. S).
- 24) Study of morphology, source and economic importance in cereals – Jowar and wheat.
- 25) Study of morphology, source and economic importance in legumes - Chickpea and red gram.
- 26) Study of morphology, source and economic importance in oil crops – Sunflower and Groundnut.
- 27) Study of perfumes and cosmetics yielding plants- Rose and Lawsonia.
- 28) Study of ornamental plants (As per theory).

Important Note: Major stress should be given on reproductive characters/features in respect of the plant types.

Distribution of Marks for B. Sc. I- BOTANY Practical

Sr. No.	Name of the Topic	Marks
1.	Bacteria	02
2.	Algae and Fungi	06
3.	Bryophytes and Pteridophytes	06
4.	Gymnosperms	03
5.	Utilization of plants	06
6.	Cytology	04
7.	Angiosperms	06
8.	Biochemistry/Physiology/Ecology	05
9.	Journal	05
10.	Tour report	05

Reference Books

1. A Hand book of Lichens - D. D. Awasthi (2000)
2. A Text book of Algae - Chopra G. L. (1969)
3. A Text book of Algae - Kumar H. D., Singh H. N. (1977)
4. A Text book of Botany - V. Singh, P. C. Pandey, Jain D. K. (1999)
5. A Text book of Botany Vol. I – Pandey S. N., S. P. Misra, P. S. Trivedi (1.982)
6. A Text book of Pteridophyte – S. N. Pandey, P. S. Trivedi, S. P. Misra (1995)
7. A Treatise on Algae - K. N. Bhatia (1980)
8. An Introduction to Embryophyta - Parihar N. S. (1961)
9. An Introduction to Fungi - Dube H. C. (1990)
10. An Introduction to Palaeobotany - Andrews H. N. (1961)
11. An Introduction to Palaeobotany - Arnold C. A. (1972)
12. An Introduction to Pteridophytes - Rashid A. (1978)
13. An Introduction to Pteridophyta (Diversity and Differentiation) -A.Rashid (1976)
14. Algae - Kumar H. D. and H. N. Singh (1991)
15. Algae - Sharma O. P. (1986)
16. Algae - Pandey B. P. (1994)
17. Anatomy of Seed Plants - Esau K. (1964)

18. Biodiversity of Plants (Floristic Aspects) - Rao R. R. (1980)
19. Biodiversity Principles and Conservation - Kumar U. (2002)
20. Biology of Lichens - Hale M. E. Jr. (1967)
21. College Botany - S. Sundararajan (1999)
22. College Botany Vol. I - Gangulee H. c., Dos K. S. and Datta C. T. (1991)
23. College Botany Vol. II - Gangulee H. C., Ka:: A. K. (1999)
24. College Botany Vol. III S. K. Mukarji (1990)
25. Cryptogamic Botany Vol. I- G. M. Smith (1955)
26. Cryptogamic Botany Vol. I - Algae and Fungi - G. M. Smith (1974)
27. Cryptogamic Botany: Bryophytes and Pteridophytes - Smith G. C. (1955)
28. Evolution and Classification of Flowering Plants- Cronquist A. (1968)
29. Flowering Plants and Their Evolution - Ronold G. (2003)
30. Fundamentals of Phycology - Khan M. (1970)
31. Fungi- Vashishtha B. K. (1996)
32. Fungi- Pandey B. P. (1994)
33. Gymnosperms- Vashishta (1976)
34. Gymnosperms- Chamberlein (1966)
35. Illustrated Manual of Ferns of Assam -S. K. Borthakur, P. Deka, K. K. Nath (2000)
36. Indian Gymnosperms in Time and Space - Ramanujan C. G. K. (1979)
37. Introduction to Bacteria - Clifton A. (1985)
38. Introductory Botany - A. Bendre, Pandey P. C. (1999)
39. Introduction to Fungi - Sundrarajan (2001)
40. Introductory Mycology - C. J. Alexopoulos, C. W. Mims, M. Blackwell
41. Introduction to Plant Anatomy - Eames and Macdeniels
42. Introductory Phycology - Kumar N. D. (1990)
43. Manual of Phycology - An Introduction to the algae and their biology – Smith G. M. (1994)
44. Morphology of Angiosperms - Eames A. J. (1961)
45. Morphology and Evolution of Vascular Plants –Gifford E. M., Foster A. S. (1989)
46. Morphology of Gymnosperms - Sporne K. R. (1967)
47. Morphology of Gymnosperms - Coulter and Chamberlein (1978)
48. Morphology of Pteridophytes - Sporne K. R. (1966)
49. Origin and Evolution of Gymnosperms - Ed Charles B. Beck (2002)
50. Phylogeny and form in the plant Kingdom - H. C. Dittmer (1964)
51. Plant Diversity and Conservation in India – An Overview, H. J. Chowdhery, S K. Murti (2000)
52. Plant Groups H. Mukherji (1990)
53. Plant Taxonomy - Benson L. (1962)
54. Pteridophyta – Vascular Cryptogams - P. C. Vashishtha (1972)
55. Principles of Angiosperm Taxonomy – Davis P. H., Heywood V. M. (1963)
56. Structure and Reproduction in Gymnosperms – Chamberlein (1935)
57. Studies in Palaeobotany - Andrews H. H. (1961)
58. Taxonomy of Angiosperms - V. Singh, D. K. Jain (1987)
59. Taxonomy of Vascular Plants – Mcmillan N. Y., Lawerence G. H. M. (1951)
60. Text Book of Botany “Diversity of Microbes and Cryptogams –
61. V. Singh, P. C. Pandey, Jain D. K. (2003-04)
62. Text Book of Fungi - O. P. Sharma (2002)
63. Text Book of Fungi - J. S. Gupta (1981)
64. The Algae - Chapman V. J. (1970)
65. The Embryology of Angiosperms – S. S. Bhojvani, S. P. Bhatnagar (1999)
66. The Ferns - Bower F. O. (1963)
67. The Fungi - Sharma P. D. (1998)
68. The Fungi – An Introduction - B. S. Mehrotra (1992)
69. The Structure and Reproduction of the Algae – Vol. I – F. E. Fritsch (1979)
70. Topics in Algae - N. D. Kamat (1982)
71. Vikas Hand book of Botany – Srivastava K. C., B. S. Dattatreya, A. B. Raizada (1977)

72. A Biologists Guide to Principles and Techniques of Practical Biochemistry. –
a. Wilson and Goulding (1996),
73. A Manual of Radiobiology - Stewart, J.C. and D. M. Hawcraft (1977)
74. Analytical Chemistry - G. L. Davida Krupadanam, D. Vijaya Prasad, Varaprasadrao, K.
L. N. Reddy, C. Sudhakar (1999)
75. An Introduction to Practical Biochemistry - D. T Plumm (1993)
76. An Introduction to Microbiology - P Tauro, K. K. Kapoor, K. S. Yadav (1996)
77. Archaeobacteria - Kandler, O. (1982)
78. Biochemistry - C. B. Powar and G. R. Chatwal (1988)
79. Biochemistry - (4th Ed.) - Stryer, L. (1995)
80. Biochemistry - K. Trehan (1987)
81. Biochemistry - D. L. Rawh (1989)
82. Biochemistry - Campbell, M. K. (1999)
83. Biochemistry - S. C. Rastogi (1993)
84. Biochemistry - Zubay, G. (1993)
85. Biological Techniques - H. S. Srivastava (1999)
86. Biophysical Chemistry - Uppadhyay, Upadhyay (1997)
87. Biochemical Thermodynamics - Jones, M. N. (1979)
88. Cell Biology - S. C. Rastogi (1992)
89. Cell Biology - C. B. Powar (2000)
90. Cell Biology, Genetics, Evolution and Ecology – P S. Verma, V K. Agarwal (2001)
91. Cell Biology - R. Dowben (1971)
92. Cell and Molecular Biology - P K. Gupta (1999)
93. Cell and Molecular Biology (2001) – E. D. P De Robertis & E. M. F De Robertis (Jr.)
94. Cell Physiology - A C. Giese (1979)
95. Cellular Energy Metabolism and Its Regulation - Atkinson, D. E. (1977)
96. Chromatographic Methods - Stock, R. and C B F Rince (1978)
97. College Botany Vol IV- S, Sunder Rajan (1992)
98. Cytogenetics - S Sunder Rajan (2000)
99. Essentials of Cell and Molecular Biology – E D, P. De Robertis, E. M. F De Robertis
(1981)
100. Elements of Biochemistry - H. S. Srivastava (1999)
101. Experimental Biochemistry - Dryer R. L. and Lata, G. F (1989)
102. Fundamental Concepts of Cell Biology - K G. Purohit (1982)
103. Fundamentals of Genetics - B. D. Singh (2001)
104. Genetics - P. K Gupta (1997)
105. Gene Action - Hartman and Suskind (1968)
106. Lehninger - Principles of Biochemistry - Nelson D. L. and M. M. Cox (2000)
107. Living Process, Book.2 Bioenergetics - Ho. M. W (1995)
108. Molecular Cell Biology - G. S. Sandhu (2002)
109. Molecular Cell Biology - H. S. Bhamrah (1999)
110. Molecular and Cellular Biology - Wolfe, S. (1993)
111. Molecular Cell Biology – Alberts, B., Bray, D.; Lewis, J.; Robert, K., Raff M. and J. D.
Watson
112. Molecular Biology - H. D. Kumar (1999)
113. Microbiology and Plant Pathology - P. D. Sharma (1999)
114. Plant Biochemistry - Ed. P. M. Dey and J. B. Harborne (2000)
115. Plant Biochemistry - Cell - Stumpf, P. K and E. E. Conn. (1981)
116. Plant Cell Biology - A Practical Approach - Harris, N. Oparka, K J. (1994)
117. Plant Cell Biology - Structure and function – Gt11nillg, B. E. S. and M. W Steer
(1996)
118. The Cell – C. P. Swanson & P. L. Webster (1980)
119. Text Book of Cell and Molecular Biology – Gupta, P. K. (1999)
120. Cutter, E. G. 1969. Part I. Cells and Tissues. Edward Arnold, London.

121. Cutter, E. G. 1971. Plant Anatomy: Experiment and Interpretation. Part II. Organs. Edward Arnold, London.
122. Esau, K. 1977. Anatomy of Seed Plants, 2nd edition, John Wiley and Sons, New York.
123. Fahn, A. 1974. Plant Anatomy, 2nd edition. Pergamon Press, Oxford.
124. Pandey B. P. Plant Anatomy. S.Chand & Co.
125. Fuller, K. W. and Gallon, J. r. 1985. Plant Products and New Technology. Calrendon Press, Oxford, New York.
126. Kocchar, S. L. 1998. Economic Botany in Tropics, 2nd edition. Macmillan India Ltd., New Delhi.
127. Sambamurthy, A. V. S. S. and Subramanyam, N. S. 1989. A Textbook of Economic Botany, Wiley Eastern Ltd., New Delhi.
128. Sharma, O. P. 1996. Hill's Economic Botany. Tata McGraw Hill Publishing Company Ltd., New Delhi.
129. Simpson, B. B. and Conner-Ogorzaly, M. 1986. Economic Botany - Plants in Our World. McGraw Hill, New York.
130. Tippto, O. and Stern, W. L. 1977. Humanistic Botany. W. W. Norton, New York.
131. Galston, A. W. 1969, Life Processes in Plants. Scientific American Library, Springer-Verlag, New York, USA.Elsevier, Amsterdam, The Netherlands.
132. Hopkins, W. G. 1995. Introduction to Plant Physiology. John Wiley & Sons, Inc., New York, USA.
133. Moore, T. C. 1989. Biochemistry and Physiology of Plant Hormones (2nd edition). Springer-Verlag, New York, USA.
134. Salisbury, F. B. and Ross, C. W. 1992. Plant Physiology (4th edition). Wadsworth Publishing Co., California, USA.
135. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
136. Odum, E. P. 1983. Basic Ecology, Saunders, Philadelphia.
137. Barbour, M. G., Burk, J. H. and Pitts, W. D. 1987. Terrestrial Plant Ecology. Benjamin/Cummings Publication Co., California.
138. Kormondy, E. J. 1996. Concepts of Ecology, Prentice-Hall of India Pvt. Ltd., New Delhi.
139. Hill, M. K. 1997. Understanding Environmental Pollution. Cambridge University Press.
140. Mackenzie, A. et al. 1999. Instant Notes in Ecology. Viva Books Pvt. Ltd., New Delhi.

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 spill, do not use water instead put some bicarbonate.

3. In case of fire, immediately switch off 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 glasswares 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 it's 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.

6) LABORATORY / FIELD WORK CARE AND SAFTY FOR
BOTANY AND ZOOLOGY STUDENTS

1. Unnecessary wastage of plant material / animals during practicals should be avoided.
2. During study tour / personal collection, more emphasis be given on study of plants / animals in nature and collection of wild plants and animals should not be carried out.

3. If at all the collection of the plant material animals is needed, it should be carried out under supervision of concerned teacher. Collection of poisonous plants / poisonous mushrooms / harmful animals should be avoided.
4. Oral intake of unknown plant material / animal, 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 / animals it should be immediately brought to the notice of the concerned teacher and reported to the registered medical practitioner.
6. Wearing of handgloves (and mask) is essential while handling poisonous plants or animals / herbarium sheets / toxic and hazardous chemicals / reagents / strong acids / strong alkalis during the experiment should be made with wash bottle / automatic 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 as 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 & dissection of animals 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)
12. Animal ethic committee should be constituted in the college where the subject Zoology is taught and the rules / norms laid down by the committee should be strictly followed while during experiment/ performing dissection on animals.

Equivalence of Papers:

Paper No.	Title of old syllabus	Title of New syllabus
I	Diversity and Classification of Plants (Non-vascular plants)	Diversity in Non-vascular plants
II	Basic Plant Biochemistry and Techniques in Cell Biology	Plant Biochemistry, Physiology and Ecology
III	Diversity and Classification of Plants (Vascular plants)	Diversity in Vascular plants
IV	Cell Biology	Cytology, Genetics and Utilization of Plants.