University of Pune
Three Year B. Sc. Degree Course in
Botany

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Board of Studies in Botany
Univesity of Pune, Pune 411 007.

1) Title of the Course : B. Sc. Botany

F. Y. B. Sc. Botany

(To be implemented from Academic Year 2013-14)

2) Preamble:

The well organized curricula including basic as well as advanced concepts in the plant sciences from first year to the third year shall inspire the students for pursuing higher studies in Botany and for becoming an enterprenur and also enanble students to get employed in the Botany subject based indutries.

3) Introduction:

At **first year of under-graduation** the topics related to the fundamentals of Botany, including exposure to diversity in plant groups and industries related to plant sciences are covered. The practical course is aimed to equipe the students with skills required for plant identification, description, classification and also applications of these plants in various industries.

At **second year under-graduation**: The level of the theory and practical courses shall be one step ahead of the first year B.Sc. courses based on content of first year shall be introduced.

At **third year under-graduation:**Theory papers in each semester shall deal with the further detailed studies of the various plant groups and other branches of Botany such as Plant Genetics, Plant Physiology, Molecular biology etc. The students will also learn about use of Statastics in the plant sciences which will be helpful to students during research in the Botany subject.

Objectives:

- To provide thorough knowledge about various plant groups from primitive to highly evolved
- To make the students aware of applications of different plants in various industries
- To highlight the potential of these studies to become an enterpruner
- To equippe the students with skills related to laboratory as well as field based studies
- To make the students aware about conservation and sustainable use of plants
- To creat foundation for further studies in Botany
- To address the socio-economical challenges related to plant sciences

- To facilitate students for taking up and shaping a successful career in Botany

4) Eligibility:

1 **First Year B.Sc. :** A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the University of Pune eligibility norms.

2 **Second Year B.Sc. :** Keeping terms of First Year of B. Sc. with Botany as one of the subjects. Other sudents if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.

3 **Third Year B.Sc.:** Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with Botany as one of the subjects.

Note: Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by the University of Pune. Reservation and relaxation will be as per the Government rules.

5 A) Examination Pattern:

First Year B. Sc. Botany

Pattern of Examination: Annual

Theory courses	Botany Theory Paper I : Annual
	Botany Theory Paper II : Annual
Practical Course	Annual

Paper/ Course No.	Title	Total Number of lectures/practicals per Term	Standard of passing		
			Internal marks out of **20**	External marks out of **80**	Total marks out of **100**
Theory Paper I BO 111 (First term)	Plant Diversity	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper I BO 111 (Second term)	Plant Morphology and Anatomy	Three lectures/Week (Total 36 lectures per term)			
Theory Paper II BO 112 (First term)	Industrial Botany I	Three lectures/Week (Total 36 lectures per term)	08	32	40 *
Theory Paper II BO 112 (Second term)	Industrial Botany II	Three lectures/Week (Total 36 lectures per term)			
Practical Paper III BO 113 (First & Second Term)	Practical	10 Practicals of 4 lectures in each term (20 practicals / year)	08	32	40 *

* Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory (100 + 100) = 200 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests

Theory examination will be of three hours duration for each theory course. There shall be 5 questions each carrying equal marks. The pattern of question papers shall be:

Question 1	8 sub-questions, each of 2 marks; answerable in 2 -3 lines and based on entire syllabus
Question 2 and 3	4 out of 6 - short answer type questions; answerable in 8 – 10 lines
Question 4	2 out of 4 – Descriptive answer type questions, answerable in 15 – 20 lines
Question 5	1 out of 2 – Descriptive answer type questions, answerable in 35 – 40 lines

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks in each term. The written test shall comprise objective type questions – Multiple Type Questions, True / False, Definitions, Answer in one or two line questions.There shall be 20 questions.
Practical: Regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02
Practical Examination: Practical examination shall be conducted by the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination.

Second Year B. Sc. Botany

Pattern of examination: Semester
Theory courses BO 211 and BO 212: Semester

BO 221 and BO 222: Semester

Practical Course: Annual

Paper/ Course No.	Title	Total Number of lectures/practicals Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
BO 211	Theory Paper I	Four lectures/Week (Total 48 per semester)	04	16	20 *
BO 212	Theory Paper II	Four lectures/Week (Total 48 per Semester)	04	16	20 *
BO 221	Theory Paper I	Four lectures/Week (Total 48 per Semester)	04	16	20 *
BO 222	Theory Paper II	Four lectures/Week (Total 48 per Semester)	04	16	20 *
Practical paper III (First & Second Semester)	Paper III	12 Practicals of 4 lectures in each Semester (24 practicals / year)	08	32	40**

* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50

**Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 + 50) = 100 marks
2. Total marks per year 200 (Theory) + 100 marks (practicals) = 300 marks
3. Internal marks for theory papers given on the basis of internal assessment tests.
4. Internal marks for Practical Course should be a regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02

Theory examination will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks as follows: The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10-15 lines	5 marks each
Question 4	1 out of 2 sub-questions, each of 10 marks; long answer type questions (20-25lines)	10 marks

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions.
Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)
Practical Examination: Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

Third Year B. Sc. Botany

Pattern of examination: Semester

Theory courses:

(Sem III: BO 331 – BO 336) : Semester

(Sem IV: BO 341 – BO 346) : Semester

Practical Course:

(BO 347 – BO 349) : Annual

Theory Papers					
Paper/Course No.	Title	Total Number of lectures Per Semester	Standard of passing		
			Internal marks out of 10 (theory) Out of 20 (practicals)	External marks out of 40 (theory) Out of 80 (practicals)	Total passing marks out of 50 (theory) and out of 100 (practicals)
SEM III					
BO 331	Paper I	48	4	16	20*
BO 332	Paper II	48	4	16	20*
BO 333	Paper III	48	4	16	20*
BO 334	Paper IV	48	4	16	20*
BO 335	Paper V	48	4	16	20*
BO 336	Paper VI	48	4	16	20*
SEM IV					
BO 341	Paper I	48	4	16	20*
BO 342	Paper II	48	4	16	20*
BO 343	Paper III	48	4	16	20*
BO 344	Paper IV	48	4	16	20*
BO 345	Paper V	48	4	16	20*
BO 346	Paper VI	48	4	16	20*
Practical Papers					
BO 347 (Semester III & IV)	Practical Paper I	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 348 (Semester III & IV)	Practical Paper II	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **
BO 349 (Semester III & IV)	Project Practical Paper III	12 Practicals of 4 lectures in each Semester (24 / year)	08	32	40 **

* Subject to compulsory passing in external examination and getting minimum 20 marks out of 50
**Subject to compulsory passing in external examination and getting minimum 40 marks out of 100

Notes:

1. Total marks: Theory for each semester (50 × 6) = 300 marks
2. Total marks per year 600 (Theory) + 300 marks (practicals) = 900 marks
3. Internal marks for theory papers be given on the basis of internal assessment tests.
4. Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

Theory examination will be of two hours duration for each theory course. There shall be 4 questions each carrying marks as per the table. The pattern of question papers shall be:

Question 1	10 sub-questions, each of 1 marks based on entire syllabus	10 marks
Question 2 and 3	2 out of 3 sub-questions, each of 5 marks; short answer type questions; answerable in 10 – 15 lines	5 marks each
Question 4	2 out of 3 sub-questions, each of 10 marks; long answer type questions (20 – 25 lines)	10 marks

Internal examination: Internal assessment of the student by respective teacher will be based on written test, 10 marks each Semester. The written test shall comprise of objective type questions – Multiple Type Questions, True / False, Definitions, Answer in Two or three line question. There shall be 20 questions.
Practicals: Regular assessment as described earlier (regular assessment of each practical for 20 marks each: Marks for journal:10, Marks for attendance: 05, Marks experimental skills: 03, Practical Work Book: 02)

Practical Examination: Practical examination shall be conducted at the respective college at the end of the academic year. Practical examination will be of more than 4 hours duration. Certified journal is compulsory to appear for practical examination. There shall be two expert and two examiners per batch for the practical examination. One of the examiners will be external.

5 B) Standard of Passing:

i. In order to pass in the first year theory examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Theory Examination.)
ii. In order to pass in the Second Year and Third Year theory examination, the candidate has to obtain 20 marks out of 50 in each course of each semester. (Minimum 16 marks out of 40 must be obtained in the University Theory Examination.)
iii. In order to pass in practical examination, the candidate has to obtain 40 marks out of 100 in each course. (Minimum 32 marks out of 80 must be obtained in the University Examination.)

5 C) ATKT Rules:

While going from F.Y.B.Sc. toS.Y.B.Sc. at least 8 courses (out of total 12) should be passed; however all F.Y.B.Sc. courses should be passed while going to T.Y.B.Sc.
While going from S.Y.B.Sc. toT.Y.B.Sc., at least 12 courses (out of 20) should be passed (Practical Course at S.Y.B.Sc. will be equivalent to 2 courses).

5 D)Award of Class:

The class will be awarded to the student on the aggregate marks obtained during the second and third year in the principal subject only. The award of the class shall be as follows:

1	Aggregate 70% and above	First Class with Distinction
2	Aggregate 60% and more but less than 70%	First Class
3	Aggregate 55% and more but less than 60%	Higher Second Class
4	Aggregate 50% and more but less than 55%	Second Class
5	Aggregate 40% and more but less than 50%	Pass Class
6	Below 40%	Fail

5 E) External Students: There shall be no external students.

5 F) Setting question papers:

F. Y. B. Sc.: For theory papers I and II annual question papers shall be set by the University of Pune and assessment done at the respective colleges. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Paper III,

papers shall be set by the University of Pune and assessment done at the respective colleges.

S. Y. B. Sc. and T. Y. B. Sc.: For theory papers for each semester and also for the annual practical examination, question papers shall be set by the University of Pune. Centralized assessment for theory papers done as per the University instructions. Questions should be designed to test the conceptual knowledge and understanding of the basic concepts of the subject. For Practical Papers,papers shall be set by the University of Pune and assessment done by the internal examiner and external examiner appointed by University of Pune.

5 G)Verification and Revaluation Rules:
As per university Statues and Rules for verification and revaluation of marks in stipulated time after declaration of the semester examination result.

6) Course Structure:

Duration: The duration of B.Sc. Botany Degree Program shall be three years.

a) Compulsory Papers:
F. Y. B. Sc.: 2 Theory + 1 Practical (Annual)
S. Y. B. Sc.: 2 Theory per semester + 1 Practical (Annual)
T. Y. B. Sc.: 6 Theory per semester + 3 Practical (Annual)

b) Question Papers :

F. Y. B. Sc. Theory paper:
University Examination – 80 marks (at the end of 2nd term)
Internal Examination – 20 marks
S. Y. / T. Y. - B. Sc. Theory paper:
University Examination – 40 marks (at the end of each term)
Internal Examination – 10 marks
F. Y. / S. Y. / T. Y. - B. Sc. Practical Paper:
University Examination – 80 marks (at the end of 2nd term)
Internal Examination – 20 marks

c) Medium of Instruction: The medium of instruction for the course shall be **English.**

7) Equivalence of Previous Syllabus:

Old Course (2008 Pattern)	**New Course (2013 Pattern)**
Paper I: Plant Diversity	BO 111: Plant Diversity, Plant Morphology and Anatomy
Paper II: Plant Resources -Utiliation and Management	BO 112: Industrial Botany
Paper III: Practical	BO 113: Practical

8) University Terms: Dates for commencement and conclusion for the first and second terms will be declared by the University authorities. Terms can be kept by only duly admitted students. The term shall be granted only on minimum 75 percent attendance at theory and practical course and satisfactory performance during the term.

9) Qualification of Teachers: M.Sc. Botany or equivalent master degree in science with class/grades and NET/SET/Ph.D. as per prevailing University/Government /UGC rules.

UNIVERSITY OF PUNE
BOARD OF STUDIES IN BOTANY
Proposed Revised Syllabus for F. Y. B. Sc. (Botany)
To be implemented from June, 2013
F. Y. B. Sc. (Botany) New Syllabus

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1. **Fundamentals of Botany: PAPER – I**

   Term- I: Plant Diversity

2. **Botany Theory Paper II**

   Term I – Industrial Botany

3. **Fundamentals of Botany: PAPER - I**

   Term- II: Morphology and Anatomy

4. **Botany Theory Paper II**

   Term- II – Industrial Botany

5. **F. Y. B. Sc. Botany Practical Paper - III based on Theory Paper I and Paper II**

UNIVERSITY OF PUNE
BOARD OF STUDIES IN BOTANY
Proposed Revised Syllabus for F. Y. B.Sc. (Botany)
To be implemented from June, 2013
PAPER – I
FUNDAMENTALS OF BOTANY
Term – I: Plant Diversity (36 Lectures)

1. **Introduction**: General outline of plant kingdom, Introduction to plant diversity with reference to following groups:-

   Cryptogams: Thallophyta (Algae, Fungi, Lichens, And Bacteria), Bryophyta and Pteridophyta, Phanerogams: Gymnosperms and Angiosperms. **3L**
2. **Algae**: General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Spirogyra*. **6L**
3. **Fungi**: General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Cystopus (Albugo).* **5L**
4. **Lichens**: General characters, Nature of Association, Types of Lichens on the basis of thallus morphology, Economic importance of lichens. **3L**
5. **Bryophytes**: General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Riccia.* **5L**
6. **Pteridophytes**: General characters, Outline classification according to G.M. Smith (1955) up to classes with reasons. Life cycle of *Nephrolepis*. **6L**
7. **Gymnosperms**: General characters, Outline classification according to Chamberlain (1934) up to classes with reasons. Life cycle of *Cycas*. **5L**
8. **Angiosperms**: General characters, Causes of evolutionary success of Angiosperms, comparative account of monocotyledons and dicotyledons. **3L**

   (Note: Development of sex organs not expected, for all the above mentioned life cycles)

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PAPER – I

FUNDAMENTALS OF BOTANY

Term – II: Morphology and Anatomy (36 Lectures)

1. **Morphology**: **4L**

1.1: Introduction, Definition and Scope.

1.2: Descriptive and Interpretative.

1.3: Importance in identification, nomenclature, classification, phylogeny and Plant breeding.

2**. Morphology of Vegetative Parts: 8L**

2.1: **Root**: Types of roots, Modifications of roots: Epiphytic, Respiratory (Pneumatophores), Parasitic and Storage roots (conical, fusiform and napiform) with examples; functions of root.

2.2: **Stem**: Modifications of Stem: Phylloclade, Runner, Stolon, Suckers, Offsets, Rhizome, Corm, Tuber and Bulb with examples. Functions of stem.

2.3: **Leaf**: Parts of typical leaf: petiole, lamina; leaf margins and apices. Types of leaves: simple, compound, venation, phyllotaxy. Modifications: tendrils, spines, scale leaves, phyllode, reproductive and trap leaves (mechanism of trapping in *Nepenthes* only) with examples. Functions of leaf.

3. Morphology of Reproductive Parts: 10L

3.1: **Inflorescence**: Types of inflorescence: Racemose (raceme, spike, corymb, umbel, catkin, spadix and capitulum), Cymose (solitary, monochasial, dichasial, polychasial), Special types (Verticillaster, Cyathium, and Hypanthodium) Significance.

3.2: **Flower**: Parts of typical flower, Types of flower (complete, incomplete), symmetry of flower and insertion of floral whorls. Floral whorls: Calyx, corolla, perianth, aestivation, modifications of calyx (pappus, petalloid, spurred), forms of corolla: polypetalous (cruciform and papilionaceous) gamopetalous (infundibuliform, bilabiate), Androecium: structure of stamen, fixation of anthers, cohesion and adhesion; Gynoecium: structure of carpel. Types of placentations.

3.3: **Fruit**: Types of fruits: Simple and dry: Achene, Cypsela, Legume, Follicle and Capsule, Fleshy: Drupe, berry, Hespiridium and pepo. Aggregate: Etaerio of berries and Etaerio of follicles. Multiple fruits: Syconus and Sorosis.

3.4: **Seed**: Parts, types, structural modifications for seed dispersal.

4. **Anatomy**: **2L**

Introduction, Definition, Importance in taxonomy, physiology, ecological interpretations, pharmacognosy and wood identification.

5. **Types of tissues:** Outline with brief description. **6L**

5.1: **Meristmatic tissues:** - Meristem, characters and types based on origin, position and plane of division, functions.

5.2: **Vascular tissues:-** Components of xylem and phloem, types of vascular bundles, functions.

5.3: **Epidermal tissues:-** Epidermis, structure of typical stomata, trichomes, motor cells; functions.

5.4: **Mechanical tissues**:- Collenchyma, sclerenchyma and xylem with functions.

6. Internal Organization of Primary Plant Body: 6L

6.1: Internal structure of dicotyledon and monocotyledon root.

6.2: Internal structure of dicotyledon and monocotyledon stem.

6.3: Internal structure of dicotyledon and monocotyledon leaf.

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PAPER- II

Term I – INDUSTRIAL BOTANY (36 Lectures)

1. **Introduction to Industrial Botany** **2L**

1.1 Concept of Industrial Botany.

1.2 Plant resources and industries: Food, fodder, fibers, medicines, timber, dyes, gum, tannins. (Two examples of each resource and the relevant industries with which they are associated).

2. **Floriculture Industry** **8L**

2.1 Introduction to floriculture.

2.2 Important floricultural crops, open cultivation practices, harvesting and marketing of Tuberose.

2.3 Greenhouse technology: Concept, advantages and limitations.

2.4 Cultivation practices (greenhouse technology), harvesting and marketing of Rose and *Gerbera.*

3. **Plant Nursery Industry** **8L**

3.1 Concept and types of nurseries: ornamental plant nursery, fruit plant nursery, medicinal plant nursery, vegetable plant nursery, orchid nursery, forest nursery (with reference to infrastructure required, outputs, commercial applications and profitability).

3.2 Propagation methods: Seed propagation, natural vegetative propagation and artificial vegetative propagation (Cutting: Stem, Layering: Air layering, Grafting: Stone grafting and Approach grafting, Budding : T-budding).

4 **Plant Tissue Culture Industry** **6L**

4.1 Concept of tissue culture.

4.2 Culture techniques: Types of explants, preparation of media, methods of sterilization, inoculation techniques, incubation and hardening.

4.3 Commercial significance

5. Agri industries: **8L**

5.1 Organic Farming: Concept, need of organic farming, types of organic fertilizers, advantages and limitations.

5.2 Seed industries: Importance of seed industries, seed production, seed processing and seed marketing with reference to cotton. Major seed industries and corporations of India.

6. Mushroom Industries: 4L

Mushroom cultivation: Plant resources, cultivation practices of Oyster mushroom, uses of mushrooms, value added products, commercial significance.

References:

1. Textbook of Economic Botany, Verma V., Ane Books Pvt. Ltd.
2. Economic Botany in the Tropics, Kochhar, Macmillan Publisher.
3. Economic Botany: Principles and Practices, Gerald E. Wickens, Springer Publication.
4. Floriculture in India, Gurcharan Singh Randhawa and Amitabha Mukhopadhyay, Allied Publishers.
5. Floriculture Marketing in India, Debashish Sengupta and Raj Kamal, Excel Books.
6. Floriculture Hand Book, Eiri, Engineers India Research in Publication.
7. Nursery Management, John Mason, Landlinks Press Publisher.
8. Plant Nursery Management: How to Start and Operate a Plant Nursery, Ray, P.K., Scientific Publishers.
9. Introduction to Plant Tissue Culture (2/e), M. K. Razdan, Science Publishers.
10. Plant Cell and Tissue Culture, Indra K. Vasil, (Eds. - Indra K. Vasil, Trevor A. Thorpe), Springer Publication.
11. The Complete Book on Organic Farming and Production of Organic Compost, NPCS Board of Consultants & Engineers, Asia Pacific Business Press Inc.
12. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm, Ann Larkin Hansen, Storey Publications.
13. Hand Book of Mushroom Cultivation, Processing and Packaging, Engineers India Research In Publishers
14. Growing Gourmet and Medicinal Mushrooms, Paul Stamets, Ten Speed Press Publishers
15. Handbook of Seed Science And Technology: Seed biology, Production, and Technology, Amarjit S. Basra, Food Products Press publishers.

PAPER- II

Term- II: INDUSTRIAL BOTANY (36 Lectures)

1. Bio-fuel Industry **6L**

1.1 Introduction and advantages.

1.2 Concept of biofuel and its need.

1.3 Plants used for biofuel production.

1.4 Biodiesel production from Caster.

1.5 Commercial significance.

2 Bio-pesticide Industry **6L**

2.1 Concept of bio-control; Integrated Pest Management (IPM).

2.2 Importance of bio pesticides.

2.3 Types of bio pesticides: Indiara, Azadiractin.

2.4 Commercial significance.

3. Industrial Mycology **6L**

3.1 Introduction

3.2 Important genera of fungi used in various industries and their products.

3.3 Products and applications of *Trichoderma*, *Penicillium*, *Aspergillus* and yeast.

3.4 Commercial significance.

4. Bio-Fertilizer Industry **6L**

4.1 Bio fertilizers : concept and need

4.2 Types of bio-fertilizers: Nitrogen fixing bio fertilizer: *Rhizobium*, Blue green algae. *Anabaena* associated with *Azolla*. Phosphate solubilizing bio-fertilizer: Bacteria and Fungi.

4.3 Commercial significance.

5 Fruit Processing Industry **6L**

5.1 Fruit processing: concept and need

5.2 Cold storage.

5.3 Types of fruit processing (canned fruits, dried fruit chips, fruit pulp, squash, jam, jelly, pickle and ketchups).

5.4 Commercial significance.

6 Plant Pharmaceutical Industry **6L**

6.1 Concept and advantages.

6.2 Types of pharmaceutical products: Churna, Asava and Arishta.

6.3 Drug plants with reference to botanical source, active principles and medicinal uses of *Adathoda zeylanica*, *Tinospora cordifolia* and *Asperagus racemosus*.

6.4 Manufacture of *Churna (Triphala churna)*, *Arishta* (*Ashokarishta*) and *Asava* (*Kumariasava*).

6.5 Concept of nutraceuticals and cosmeceuticals.

6.6 Commercial significance of Amla and Aloe.

References:

1. The Complete Book on Organic Farming and Production of Organic Compost, NPCS Board of Consultants & Engineers, Asia Pacific Business Press Inc.
2. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farm, Ann Larkin Hansen, Storey Publications.
3. Deore and Laware (2011).Liquid Organic Fertilizer: An Approach towards Organic Vegetable Production. LAP LAMBERT Academic Publishing (2011)
4. A Pharmacognosy and Pharmacobiotechnology. New Age international (P) Limited, Publishers (formerly Wiley Eastern Limited)
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9. Vaidya S.S. and Dole V.A. Bhaishyajakalpana, Anmol Prakashan, pune
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17. Singh, R.S. 2004, Plant Diseases, Oxford & IBH Publishing Co. Pvt. Ltd., Delhi.
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23. The Complete Technology Book on Biofertilizer and Organic Farming. NIIR PROJECT CONSULTANCY SERVICES.

F. Y. B.Sc. BOTANY PRACTICAL PAPER – III

Based on Theory Paper I and Paper II

1. Modifications of root and stem. 1P
2. Study of leaf (parts of leaf, types: simple and compound; sessile and petiolate; venation: parallel and reticulate) (Glossary of terminologies be given with the protocol). 1P
3. Study of Inflorescence. 1P
   a) Racemose: Raceme, Spike, Spadix, Catkin, Umbel and Capitulum.
   b) Cymose: Solitary cyme, Uniparous cyme: helicoid and scorpiod, Biparous cyme and Multiparous cyme.
   c) Special type: Verticillaster, Hypanthodium and Cyathium.
4. Study of flower with respect to Calyx, Corolla and Perianth: (Glossary of terminologies is given with the protocol). 1P
5. Study of flower with respect to Androecium and Gynoecium. 1P
6. Study of fruits and seed with suitable examples. 1P

   Simple fruit: fleshy – Berry and Drupe; Dry: Achene, Cypsella and Legume

   Agrregate fruit: Etaerio of follicles and Etaerio of Berries.

   Multiple fruit: Syconus and Sorosis.

   Seed: parts of seed and types of seed (monocotyledonous dicotyledonous, albuminous, exalbuminous)
7. Study of internal primary structure of dicotyledonous root, stem and leaf. e.g. Sunflower. 1P
8. Study of internal primary structure of monocotyledonous root, stem and leaf. e.g. Maize. 1P
9. Study of *Spirogyra.* 1P
10. Study of *Cystopus (Albugo)* 1P
11. Study of *Riccia*. 1P
12. Study of *Nephorlepis.* 1P
13. Study of *Cycas.* 1P
14. Study of plant resources in industries: food, fodder, fiber, medicine, timber and gum (one example of each) 1P

15. Study of artificial plant propagation: 1P

    Stem cutting (demonstration of three subtypes)

    Air Layering, Approach grafting, and T- budding

16. Study of plant tissue culture techniques: Demonstration of various stages. 1P

17. Cultivation of Oyster mushroom and demonstration of value added mushroom products. 1P

18. Study of plant resources used in biopesticides. 1P

    (Indiara, Azadiractin)

19. Study of industrially important fungi and their products. 1P

    Ganoderma: *Ganoderma* tablets, *Aspergillus*: citric acid; *Yeast*: Bakery products; *Penicillium*: Penicillin and *Trichoderma*.

20. Study of types of Biofertilizers: *Rhizobium*, *Azatobacter*, BGA, *Azolla*.

    Phosphate Solubilizing Bacteria. Green manure (preferably Crotolaria/ Gliricidia/locally available material). 1P

21. Preparation of Jam and Squash. 1P

22. A) One botanical excursion to study plant diversity.

B) Visit to one of the following industries. (Study/project report is compulsory).
1) Floriculture unit 2) Greenhouse 3) Pharmaceutical industry 4) Nursery and 5) Mushroom cultivation unit.

(Note: Visits mentioned in the practical No. 22 (A & B) are compulsory. It carries 10 marks at the time of annual practical examination.)