

**Anekant Education of Society's  
Tuljaram Chaturchand College of Arts, Science and  
Commerce, Baramati**

**Autonomous**

**Course Structure for F. Y. B. Sc. BOTANY**

<b>Class</b>	<b>Semester</b>	<b>Paper</b>	<b>Title of Paper</b>	<b>Credits</b>
<b>F.Y.B.Sc.</b>	<b>I</b>	BOT 1101	Plant Diversity	02
		BOT 1102	Applications of Botany - I	02
		BOT 1103	Practical based on BOT 1101 and BOT 1102	02
	<b>II</b>	BOT 1201	Angiosperm Morphology	02
		BOT 1202	Applications of Botany - II	02
		BOT 1203	Practical based on BOT 1201 and BOT 1202	02
<b>S.Y.B.Sc.</b>	<b>III</b>	BOT2301	Angiosperms Taxonomy	03
		BOT2302	Plant Physiology	03
	<b>IV</b>	BOT2401	Anatomy and Embryology	03
		BOT2402	Plant Ecology	03
	<b>Annual</b>	BOT2403	Practical based on BOT2301, BOT2302, BOT2401 and BOT2402	04
<b>T.Y.B.Sc.</b>	<b>V</b>	BOT3501	Cryptogamic Botany (Algae, Fungi, Bryophytes and Pteridophytes)	03
		BOT3502	Spermatophyta and Palaeobotany	03
		BOT3503	Cell and Molecular Biology	03
		BOT3504	Industrial Botany	03
		BOT3505	Biostatistics	03
		BOT3506	Research Methodology	03
	<b>VI</b>	BOT3601	Plant Physiology and Biochemistry	03
		BOT3602	Plant Biotechnology	03
		BOT3603	Genetics and Plant Breeding	03
		BOT3604	Plant Pathology	03
		BOT3605	Pharmacognosy	03
		BOT3606	Botanical Techniques	03
	<b>Annual</b>	BOT3607	Practical based on BOT3501 to BOT3506	04
	<b>Annual</b>	BOT3608	Practical based on BOT3601 to BOT3606	04
	<b>Annual</b>	BOT3609	Project	04

## Program Outcomes (Pos) for B. Sc. Program

PO1	<b>Disciplinary Knowledge:</b> Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
PO2	<b>Critical Thinking and Problem solving:</b> Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	<b>Social competence:</b> Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibit thoughts and ideas effectively in writing and orally
PO4	<b>Research-related skills and Scientific temper :</b> Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	<b>Trans-disciplinary knowledge:</b> Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem
PO6	<b>Personal and professional competence:</b> Performing dependently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	<b>Effective Citizenship and Ethics:</b> Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	<b>Environment and Sustainability:</b> Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	<b>Self-directed and Life-long learning:</b> Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

## Academic Year 2019-2020

Class : **F. Y. B. Sc. (Semester - I)**

Paper Code: **BOT 1101**

Paper : **I**

Title of Paper: **Plant Diversity**

Credit : **2**

No. of lectures: **36**

### **A) Learning Objectives:**

1. To create awareness of plant diversity
2. To give idea of economic importance of cryptogams and phanerogams

### **B) Learning Outcome:**

By the end of the course, students will be able to:

- CO1. Identify, describe and study in detail life cycle of cryptogams.
- CO2. Provide plant description; describe the morphology and reproductive structure of cryptogams.
- CO3. Gain the proficiency in the identification of cryptogams.
- CO4. Knowledge of comparison between cryptogams and other plant groups.
- CO5. Knowledge of scope of the cryptogams diversity.
- CO6. Knowledge about habitat conservation of cryptogams diversity.
- CO7. Knowledge about the applications of cryptogams.

### **Credit - I (18 L)**

#### **Unit - 1**

- 1.1 **Introduction** : General outline, scope and importance of study of plant kingdom, Awareness and need of conservation (3L).
- 1.2 **Algae** : Introduction, habitat, thallus diversity, pigments, reserve food and types of reproduction, Classification with reasons according to Chapman and Chapman (1973), Life cycle patterns of *Spirogyra* and *Sargassum*. Economic importance of algae (7L).

#### **Unit - 2**

- 2.1 **Fungi** : General characters, thallus structure, mode of nutrition and types of reproduction, pathogenic importance of fungi, Classification with reasons according to G. C. Ainsworth (1973), Life cycle patterns of *Rhizopus* and *Puccinia*. Economic importance of fungi (6L)
- 2.2 **Lichens** : General characters, and Types of Lichens on the basis of thallus morphology. Economic importance of lichens. (2L)

### **Credit - II (18 L)**

#### **Unit - 3**

- 3.1 **Bryophytes** : Occurrence and Salient features, Classification with reasons according to G.M. Smith (1955), Life cycle patterns of *Riccia* and *Funaria*. Economic importance of Bryophytes (4L)

- 3.2 **Pteridophytes** : Occurrence and Salient features, Classification with reasons according to K. R. Sporne (1975), Life cycle patterns of *Equisetum* and *Adiantum*. Economic importance of Pteridophytes (5L)

#### Unit - 4

- 4.1 **Gymnosperms** : Occurrence and Salient features, Classification with reasons according to Chamberlain (1934), Life cycle patterns of *Cycas* and *Pinus*. Economic importance of Gymnosperms (6L)
- 4.2 **Angiosperms** : Occurrence and General characters, means of evolutionary success of Angiosperms, comparative account of monocotyledons and dicotyledons (3L)

#### References :

1. Brodie J. and Lewis J. (2007) : (Ed.) Unravelling the algae: the past, present and future of algal systematics. CRC press, New York, pp 335.
2. Bellinger E.G. and Sigeo D.C. (2010) : Freshwater algae: Identification and use as bioindicators, Willey-Blackwell, UK, pp. 271.
3. Cole K.M. and Sheath R.G. (1990) : Biology of the red algae. Cambridge University Press.USA. pp. 503.
4. Desikachary T.V. (1959) : Cyanophyta. ICAR, New Delhi.
5. Graham L.E. and Wilcox L.W. (2000) : Algae. Penticce-Hall, Inc, pp. 640
6. Krishnamurthy V. (2000) : Algae of India and neighboring countries I. Chlorophycota, Oxford & IBH, New Delhi.
7. Lee R.E. (2008) : Phycology. Cambridge University Press, pp.547
8. Misra J.N. (1996) : Phaeophyceae in India. ICAR, New Delhi.
9. Prescott G.W. (1969) : The algae.
10. Smith G.M. (1950) : The fresh water algae of the United States, McGraw Hill New York.
11. Srinivasan K.S. (1969) : Phycologia India. Vol. I & II, BSI, Calcutta.
12. Das Dutta and Gangulee. College Botany Vol I, Central Book Depot.
13. Vashista B.R, Sinha A.K and Singh V.P. (2005) : Botany for degree students –Algae, S.Chand's Publication.
14. Ainsworth, Sussman and Sparrow (1973) : The fungi. Vol IV A & IV B. Academic Press.
15. Alexopolous C.J., Minms C.W. and Blackwell M. (1999) : (4<sup>th</sup> edn) Introductory Mycology. Willey, New York, Alford R.A.
16. Deacon J.W. (2006). Fungal Biology (4<sup>th</sup> Ed.) Blackwell Publishing, ISBN. 1405130660.
17. Kendrick B. (1994). The fifth kingdom (paperback), North America, New York Publisher: 3<sup>rd</sup> edn, ISBN- 10: 1585100226.
18. Kirk et al. (2001) : Dictionary of fungi, 9<sup>th</sup> edn, Wallingford: CABI, ISBN: 085199377X.
19. Mehrotra R.S. and Aneja K.R. (1990) : An introduction to mycology. New Age Publishers, ISBN 8122400892.

20. Miguel U., Richard H., and Samuel A. (2000) : Illustrated dictionary of the Mycology. Elvira Aguirre Acosta, Publisher: St. Paul, Minn: APS press, ISBN 0890542570.
21. Webster J. and Rpland W. (2007) : Introduction to fungi (3<sup>rd</sup> Edn) Cambridge University Press, 978-0-521-80739-5.
22. Dube H.C. (2004) : An Introduction to fungi. Vikas Publishers.
23. Sharma O.P. (2010) : A text book of fungi. S.Chand's Publication.
24. Vashista B.R and Sinha A.K (2008) : Botany for degree students – Fungi, S.Chand's Publication.
25. Cavers F. (1976) : The interrelationships of the Bryophytes. S.R. Technic, Ashok Rajpath, Patana.
26. Chopra R.N. and Kumar P.K. (1988) : Biology of Bryophytes. John Wiley & Sons, New York, NY.
27. Kashyap S.R. (1929) : Liverworts of the Western Himalayas and the PunjabPlain. Part 1, Chronica Botanica, New Delhi.
28. Kashyap S.R. (1932) : Liverworts of the Western Himalayas and the PunjabPlain (illustrated): Part 2. Chronica Botanica, New Delhi.
29. Parihar N.S. (1980) : Bryophytes: An Introduction to Embryophyta. Vol I. Central Book Depot, Allahabad.
30. Prem Puri (1981) : Bryophytes: Morphology, Growth and Differentiation. Atma Ram and Sons, New Delhi.
31. Udar R. (1975) : Bryology in India. Chronica Botanica, New Delhi.
32. Udar R. (1970) : Introduction to Bryophytes. Shashidhar Malaviya Prakashan. Lucknow.
33. Watson E.V. (1971) : Structure and Life of Bryophytes. 3<sup>rd</sup> Edn. Hutchinson University Library, London.
34. Vashista B.R., Sinha A.K., Kumar A. (2008) : Botany for degree students – Bryophyta, S.Chands Publication.
35. Agashe S.N. (1995) : Paleobotany. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
36. Arnold A.C. (2005) : An Introduction to Paleobotany. Agrobios (India). Jodhpur.
37. Eames E.J. (1983) : Morphology of Vascular Plants. Standard University Press.
38. Rashid A. (1999) : An Introduction to Pteridophyta. Vikas Publishing House Pvt. Ltd. New Delhi.
39. Sharma O.P. (1990) : Textbook of Pteridophyta. MacMillan India Ltd. Dehi.
40. Smith G.M. (1955) : Cryptogamic Botany Vol II. McGraw Hill.
41. Sporne K.R. (1986) : The morphology of Pteridophytes. Hutchinson University Library, London.
42. Stewart W.N. and Rothwell G.W. (2005) : Paleobotany and the Evolution of Plants. 2<sup>nd</sup> Edn. Cambridge University Press.
43. Vashista B.R., Sinha A.K., Kumar A. (2008) : Botany for degree students – Pteridophyta, S.Chands Publication.
44. Gangulee and Kar (2006) : College Botany. New Central Book Agency.

45. Sundar Rajan S. (1999) : Introduction to Pteridophyta. New Age International Publishers, New Delhi.
46. Surange K.R. (1966) : Indian Fossil Pteridophytes. CSIR., New Delhi.
47. Parihar N.S. (1976) : Biology and Morphology of Pteridophytes. Central Book Depot.

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Choice Based Credit System Syllabus (2019  
Pattern)

**Mapping of Program Outcomes with Course  
Outcomes**

**Class:** F.Y.B. Sc. (Sem. I)

**Subject:** Botany

**Course:** Plant Diversity

**Course Code:** BOT 1101

**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3		2						3
CO 2	3								
CO 3		3							
CO 4	3								
CO 5				3					
CO 6		2	3					3	
CO 7	2	1		2					

**Justification for the mapping**

**PO1: Disciplinary Knowledge**

- CO1. Identify, describe and study in detail life cycle of Phanerogams.
- CO2. Provide plant description, describe the morphology and reproductive structure of cryptogams.
- CO4. Knowledge of comparison between cryptogams and other plant groups.
- CO7. Knowledge about the applications of cryptogams.

**PO2: Critical Thinking and Problem Solving**

- CO3. Gain the proficiency in the identification of cryptogams.
- CO6. Knowledge about habitat conservation of cryptogams diversity.

CO7. Understand the local flora with respect to Phanerogams.

**PO 3: Social competence**

CO1. Identify, describe and study in detail life cycle of Phanerogams.

CO6. Knowledge about habitat conservation of cryptogams diversity.

**PO 4: Research-related skills and Scientific temper**

CO5. Knowledge of scope of the cryptogams diversity.

CO7. Knowledge about the applications of cryptogams

**PO 8: Environment and Sustainability**

CO6. Knowledge about habitat conservation of cryptogams diversity.

**PO 9: Self-directed and Life-long Learning**

CO1. Identify, describe and study in detail life cycle of cryptogams.

Class : **F. Y. B. Sc. (Semester - I)**  
Paper Code : **BOT 1102**  
Paper : **II** Title of Paper : **Applications of Botany - I**  
Credit : **2** No. of lectures : **36**

**A) Learning Objectives:**

1. To create awareness about industrial applications of Botany
2. To provide technical knowledge of floriculture and nursery industries.

**B) Learning Outcome:**

By the end of the course, students will be able to:

- CO1. Understand basics of plant resource based industries.
- CO2. Knowledge about natural and artificial propagation methods.
- CO3. Knowledge about different types of nurseries and its commercial applications.
- CO4. Develop floriculture industries on their own.
- CO5. Develop plant tissue culture industry.
- CO6. Get expertise to develop agro based industries.
- CO7. Get expertise in field of Industrial Botany.

**Credit - I**

**Unit - 1 (16L)**

- 2.1 **Introduction to Industrial Botany** : Concept of Industrial Botany. Plant resources and industries : Food, fodder, fibers, medicines, timber, dyes, gum, tannins. (Two examples of each resource and the relevant industries). **(2L)**
- 2.2 **Floriculture Industry** : Introduction to floriculture. Important floricultural crops, open cultivation practices, harvesting and marketing of Tuberose. Greenhouse technology : Concept, advantages and limitations. Cultivation practices (greenhouse technology), harvesting and marketing of *Gerbera*. **(6L)**
- 2.3 **Plant Nursery Industry** : Concept and types of nurseries : ornamentals, fruit plants, medicinal plants, vegetables, orchids, forest nursery w.r.t. infrastructure, outputs, commercial applications. 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). **(8L)**

**Credit - II**

**Unit - 2 (20L)**

- 2.1 **Plant Tissue Culture Industry** : Concept, culture techniques : Types of explants, preparation of media, methods of sterilization, inoculation techniques, incubation and hardening. Commercial significance **(6L)**



- 2.2 **Agri Industries** : Organic Farming : Concept and need, types of organic fertilizers, advantages and limitations. Seed industries: Importance of seed industries, seed production, seed processing and seed marketing with reference to cotton. Major seed industries and corporations of India. (8L)
- 2.3 **Mushroom Industries** : Mushroom cultivation : Plant resources, cultivation practices of oyster and button mushroom, uses of mushrooms, value added products, commercial significance. (6L)

### References:

1. Verma V. (2013) : Textbook of Economic Botany, Ane Books Pvt. Ltd.
2. Kochhar S. L. (2012) : Economic Botany in the Tropics, , Macmillan Publisher.
3. Gerald E. Wickens (2001) : Economic Botany: Principles and Practices, Springer Publication.
4. Gurcharan Singh Randhawa and Amitabha Mukhopadhyay (1986) : Floriculture in India, Allied Publishers.
5. Debashish Sengupta and Raj Kamal (2009) : Floriculture Marketing in India, , Excel Books.
6. Floriculture Hand Book, Eiri, Engineers India Research in Publication.
7. John Mason (2004) : Nursery Management, Landlinks Press Publisher.
8. Ray, P.K. (2012) : Plant Nursery Management: How to Start and Operate a Plant Nursery, Scientific Publishers.
9. Razdan M. K. (2017) : Introduction to Plant Tissue Culture (2/e), Science Publishers.
10. Vasil K. (1994) : Plant Cell and Tissue Culture, Indra, (Eds. - Indra K. Vasil, Trevor A. Thorpe), Springer Publication.
11. The Complete Book on Organic Farming and Production of Organic Compost (2008) : 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 Farming (Ann Larkin Hansen) (2010) : Storey Publications.
13. Hand Book of Mushroom Cultivation, Processing and Packaging (2007) : Engineers India Research In Publishers
14. Paul Stamets (2011) : Growing Gourmet and Medicinal Mushrooms, Ten Speed Press Publishers
15. Amarjit S. Basra (2006) : Handbook of Seed Science And Technology: Seed biology, Production, and Technology, Food Products Press publishers.

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Choice Based Credit System Syllabus (2019 Pattern)

**Mapping of Program Outcomes with Course Outcomes**

**Class:** F.Y.B. Sc. (Sem. I)

**Subject:** Botany

**Course:** Applications of Botany - I

**Course Code:** BOT 1102

**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3						3		
CO 2	3								
CO 3	3								
CO 4				3					
CO 5				3					
CO 6				3	3	2		2	
CO 7				3		1			

**Justification for the mapping**

**PO1: Disciplinary Knowledge**

- CO1. Understand basics of plant resource based industries.
- CO2. Knowledge about natural and artificial propagation methods.
- CO3. Knowledge about different types of nurseries and its commercial applications.

**PO 4: Research-related skills and Scientific temper**

- CO4. Develop floriculture industries on their own.
- CO5. Develop plant tissue culture industry.
- CO6. Get expertise to develop agro based industries.
- CO7. Get expertise in field of Industrial Botany.

**PO5: Trans-disciplinary Knowledge**

- CO6. Get expertise to develop agro based industries.

**PO6: Personal and Professional Competence**

- CO6. Get expertise to develop agro based industries.
- CO7. Get expertise in field of Industrial Botany.

**PO 7: Effective Citizenship and Ethics**

- CO1. Understand basics of plant resource based industries.

**PO 8: Environment and Sustainability**

- CO6. Get expertise to develop agro based industries.

Class : **F. Y. B. Sc. (Semester - I)**  
Paper Code : **BOT 1103**  
Paper : **III** Title of Paper : **Practical Course**  
Credit : **2** No. of Practicals : **11**

**A) Learning Objectives :**

1. To give knowledge of handling of microscope and identification of lower and higher plants.
2. To give hands-on training of production of agroproducts.

**B) Learning Outcome:**

By the end of the course, students will be able to:

- CO1. Expertise in handling of microscope.  
CO2. Knowledge of morphological and anatomical variations in cryptogams.  
CO3. Identify the cryptogams.  
CO4. Develop entrepreneurship in agro products.  
CO5. Expertise in artificial plant propagation.  
CO6. Get knowledge of career opportunities in plant based industries.  
CO7. Expertise in the field of Industrial Botany.

1. Study of *Spirogyra* 1P
2. Study of *Rhizopus* 1P
3. Study of Lichen diversity 1P
4. Study of *Riccia* 1P
5. Study of *Equisetum* 1P
6. Study of *Cycas* 1P
7. Study of plant resources in industries: fodder, fiber, medicine & gum 1P
8. Study of artificial plant propagation : Stem cutting (demonstration of three subtypes), Air Layering, Approach grafting, and T- budding 1P
9. Study of plant tissue culture techniques : Demonstration of various stages 1P
10. Cultivation of Oyster mushroom and demonstration of value added mushroom products 1P
11. One botanical excursion to study plant diversity - Botanical garden or Local area. (Study / visit report is compulsory).

**(Note: Visit mentioned in the practical No. 11 is compulsory. It carries 10 marks at the time of practical examination).**

Choice Based Credit System Syllabus (2019 Pattern)  
**Mapping of Program Outcomes with Course Outcomes**

**Class:** F.Y.B. Sc. (Sem. I)

**Subject:** Botany

**Course:** Practical Course

**Course Code:** BOT 1103

**Weightage:** 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

Course Outcomes	Programme Outcomes (POs)								
	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1									
CO 2	3	2							
CO 3	3	3							3
CO 4			3					2	
CO 5									
CO 6									
CO 7				2					

**Justification for the mapping**

**PO1: Disciplinary Knowledge**

CO2. Knowledge of morphological and anatomical variations in cryptogams.

CO3. Identify the cryptogams.

**PO2: Critical Thinking and Problem Solving**

CO2. Knowledge of morphological and anatomical variations in cryptogams.

CO3. Identify the cryptogams.

**PO 3: Social competence**

CO4. Develop entrepreneurship in agro products.

**PO 4: Research-related skills and Scientific temper**

CO7. Expertise in the field of Industrial Botany.

**PO 8: Environment and Sustainability**

CO4. Develop entrepreneurship in agro products.

**PO 9: Self-directed and Life-long Learning**

CO3. Identify the cryptogams.