



आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश
IFTM University, Moradabad, Uttar Pradesh
NAAC ACCREDITED

SCHOOL OF SCIENCES
DEPARTMENT OF BOTANY

Bachelor of Science (Honors Botany)

THREE YEAR PROGRAMME

[W. E. F. ACADEMIC SESSION: 2020 - 21]

IFTM UNIVERSITY
N.H.-24, Lodhipur Rajput, Delhi Road, Moradabad, Uttar Pradesh-244001
www.iftmuniversity.ac.in



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**SCHOOL OF SCIENCES
DEPARTMENT OF BOTANY**

**Study & Evaluation Scheme of
Bachelor of Science (Botany)
[Session 2020-21]**

Programme	: Bachelor of Science (Honours) Botany
Course Level	: UG Course
Duration	: Three Year (Six Semester) Full Time
Medium of Instruction	: English
Minimum Required Attendance	: 75%
Maximum Credits	: 176

Programme Outcomes (POs):

Students completing this course will be able to:

- To understand different field of Botany such as lower and higher plants, systematics of flowering plants, plant ecology, plant physiology, biochemistry, anatomy, reproduction in plants, genetics, cell and molecular biology of various forms of plants.
- Enhance the understanding about the diversity of micro-organisms, their classification, structure and growth.
- Identify various life forms of plants, their interaction with the environment and vice-versa.
- Understand the economic and other social importance of plants and plant products.
- Know how to develop the plant species by using various techniques of plant breeding.
- Think logically and organize tasks into a structured form.
- Analyze data using appropriate statistical methods
- Prepare themselves for higher studies in the field of Botany.

Course structure and evaluation scheme

B. Sc. (Honours) Botany I Year

S. No.	Subject Code	Subject Title	Periods			EVALUATION SCHEME				Total	Credit
			L	T	P	Internal Exam			External Exam		
						MSE	AS+AT	Total			
Semester-I											
1.	BBO (H)-101	DIVERSITY OF MICROBES	3	1	0	10+10	5+5	30	70	100	4
2.	BBO (H)-102	ALGAE AND BRYOPHYTES	3	1	0	10+10	5+5	30	70	100	4
3.	BCHE (H)-101	INORGANIC CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
4.	BCHE (H)-102	ORGANIC CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
5.	BZO (H)-101	LOWER NON- CHORDATES	3	1	0	10+10	5+5	30	70	100	4
6.	BZO (H)-102	HIGHER NON-CHORDATES	3	1	0	10+10	5+5	30	70	100	4
7.	BBO (H)-151	BOTANY LAB-1	-	-	4	-	-	30	70	100	2
8.	BCHE (H)-151	CHEMISTRY LAB-1	-	-	4	-	-	30	70	100	2
9.	BZO (H)-151	ZOOLOGY LAB-1	-	-	4	-	-	30	70	100	2
10.	AECC*	ENVIRONMENTAL STUDIES	3	-	-	10+10	5+5	30	70	100*	3*
		Total	21	6	12	-	-	-	-	900	30
Semester-II											
1.	BBO (H)-201	PTERIDOPHYTES, GYMNOSPERM AND PALAEOBOTANY	3	1	0	10+10	5+5	30	70	100	4
2.	BBO (H)-202	SYSTEMATICS OF FLOWERING PLANTS AND ECONOMIC BOTANY	3	1	0	10+10	5+5	30	70	100	4
3.	BCHE (H)-201	PHYSICAL CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
4.	BCHE (H)-202	BASIC CONCEPT OF ANALYTICAL CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
5.	BZO (H)-201	CELL BIOLOGY AND MOLECULAR BIOLOGY	3	1	0	10+10	5+5	30	70	100	4
6.	BZO (H)-202	GENETICS	3	1	0	10+10	5+5	30	70	100	4
7.	BBO (H)-251	BOTANY LAB-2	-	-	4	-	-	30	70	100	2
8.	BCHE (H)-251	CHEMISTRY LAB-2	-	-	4	-	-	30	70	100	2
9.	BZO (H)-251	ZOOLOGY LAB-2	-	-	4	-	-	30	70	100	2
		Total	18	6	12	-	-	-	-	900	30

B. Sc. (Honours) Botany II Year

S. No.	Subject Code	Subject Title	Periods			EVALUATION SCHEME				Total	Credit
			L	T	P	Internal Exam			External Exam		
						MSE	AS+AT	Total			
Semester-III											
1.	BBO (H)-301	SEXUAL REPRODUCTION IN FLOWERING PLANTS	3	1	0	10+10	5+5	30	70	100	4
2.	BBO (H)-302	PLANT ANATOMY	3	1	0	10+10	5+5	30	70	100	4
3.	BCHE (H)-301	INORGANIC CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
4.	BCHE (H)-302	ORGANIC CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
5.	BZO (H)-301	CHORDATA	3	1	0	10+10	5+5	30	70	100	4
6.	BZO (H)-302	DEVELOPMENTAL BIOLOGY	3	1	0	10+10	5+5	30	70	100	4
7.	BBO (H)-351	BOTANY LAB-3	-	-	4	-	-	30	70	100	2
8.	BCH (H)-351	CHEMISTRY LAB-3	-	-	4	-	-	30	70	100	2
9.	BZO (H)-351	ZOOLOGY LAB-3	-	-	4	-	-	30	70	100	2
		Total	18	6	12	-	-	-	-	900	30
Semester-IV											
1.	BBO (H)-401	CELL AND MOLECULAR BIOLOGY	3	1	0	10+10	5+5	30	70	100	4
2.	BBO (H)-402	GENETICS, PLANT BREEDING AND BIOSTATISTICS	3	1	0	10+10	5+5	30	70	100	4
3.	BCHE (H)-401	PHYSICAL CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
4.	BCHE (H)-402	ENVIRONMENTAL CHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
5.	BZO (H)-401	PHYSIOLOGY AND BIOCHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
6.	BZO (H)-402	ANIMAL DISTRIBUTION AND EVOLUTION	3	1	0	10+10	5+5	30	70	100	4
7.	BBO (H)-451	BOTANY LAB-4	-	-	4	-	-	30	70	100	2
8.	BCH (H)-451	CHEMISTRY LAB-4	-	-	4	-	-	30	70	100	2
9.	BZO (H)-451	ZOOLOGY LAB-4	-	-	4	-	-	30	70	100	2
10.	UDM*	DISASTER MANAGEMENT	3	-	-	10+10	5+5	30	70	100*	3*
		Total	21	6	12	-	-	-	-	900	30

* Audit courses which are mandatory for UG courses.

B. Sc. (Honours) Botany III Year

S. No.	Subject Code	Subject Title	Periods			EVALUATION SCHEME				Total	Credit
			L	T	P	Internal Exam			External Exam		
						MSE	AS+ AT	Total			
Semester-V											
1.	BBO (H)-501	PLANT PHYSIOLOGY	3	1	0	10+10	5+5	30	70	100	4
2.	BBO (H)-502	PLANT BIOCHEMISTRY	3	1	0	10+10	5+5	30	70	100	4
3.	BBO (H)-503	STRESS BIOLOGY	3	1	0	10+10	5+5	30	70	100	4
4.	BBO (H)-504	ANALYTICAL TECHNIQUES IN PLANT SCIENCES	3	1	0	10+10	5+5	30	70	100	4
5.	BBO (H)-505	PLANT DIVERSITY AND HUMAN WELFARE	3	1	0	10+10	5+5	30	70	100	4
6.	BBO (H)-506	NURSERY & GARDENING	3	1	0	10+10	5+5	30	70	100	4
7.	BBO (H)-551	BOTANY LAB-5A	-	-	4	-	-	30	70	100	2
8	BBO (H)-552	BOTANY LAB-5B	-	-	4	-	-	30	70	100	2
		Total	18	6	12	-	-	-	-	800	28
Semester-VI											
1.	BBO (H)-601	FUNDAMENTALS OF BIOTECHNOLOGY	3	1	0	10+10	5+5	30	70	100	4
2.	BBO (H)-602	PLANT ECOLOGY	3	1	0	10+10	5+5	30	70	100	4
3.	BBO (H)-603	NATURAL RESOURCES MANAGEMENT	3	1	0	10+10	5+5	30	70	100	4
4.	BBO (H)-604	RESEARCH METHODOLOGY	3	1	0	10+10	5+5	30	70	100	4
5.	BBO (H)-605	ETHNOBOTANY	3	1	0	10+10	5+5	30	70	100	4
6.	BBO (H)-651	BOTANY LAB-6	-	-	4	-	-	30	70	100	2
7.	BBO (H)-652	PROJECT/DISSERTATION+ VIVA-VOCE	-	-	6	-	-	50	150	200	6
		Total	15	5	10	-	-	-	-	800	28

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-I Year (I Semester)

BBO (H)-101: DIVERSITY OF MICROBES

Objective: The objective of this course is to expose the students to bacterial structure, types, mode of nutrition in bacteria, reproduction, economic importance of cyanobacteria and bacteria. This course will also enhance the knowledge of the students about viruses, viroids, Fungi and their economic importance.

UNIT-I **(08 Sessions)**

Structure of bacterial cell, flagellation and mode of nutrition in bacteria.

Reproduction in bacteria: asexual (binary fission and endospore formation) and sexual (genetic recombination).

UNIT-II **(06 Sessions)**

Role of bacteria and cyanobacteria in agriculture.

Microorganisms and the production of alcoholic beverages, antibiotics and single cell protein.

UNIT-III **(08 Sessions)**

Viruses: General characters of viruses, classification of viruses based on host, symptoms of virus infection in plants; transmission of plant viruses; viroids. Economic importance of viruses.

Unit-IV **(10 Sessions)**

General characters of Fungi, classification of Fungi (as per Alexopoulos and Mims, 1979).

Systematic position, occurrence, structure of mycelium, asexual reproduction, sexual reproduction and graphic life cycle of following fungal types:

- a. Phycomycetes: *Albugo*.
- b. Ascomycetes: *Aspergillus*
- c. Basidiomycetes: *Puccinia and Agaricus*
- d. Deuteromycetes: *Alternaria and Cercospora*

UNIT-V **(08 Sessions)**

A general account of Lichens with economic importance.

Course Outcomes:

Students completing this course will be able to:

- Understand the diversity of micro-organisms such as viruses, bacteria, fungi lichens, their classification, structure and growth.
- Increase the understanding the economic values of bacteria, fungi, mycorrhizae, lichens and develop theoretical & technical skills about them.

Suggested Readings:

1. Bodke S.S. and N.M. Dhekle (2007): Diversity of Microbes and Cryptogams, Mansi prakashan, Nanded
2. Vashishta B.R. (1990) Botany for Degree Students Part-II Fungi, S. Chand & Co. New Delhi.
3. Alexopoulos C.J. & C.W. Mims (1979): Introductory Mycology Wiley Eastern Ltd., New Delhi
4. Smith G.M. (1971): Cryptogamic Botany Vol-I. Algae and Fungi, Tata McGraw Hill PublishingCo. New Delhi.
5. Dubey H.C. (1990): An Introduction to Fungi Vikas Publishing House, New Delhi.
6. Sharma P.D. (1995): The Fungi. Rastogi & Co., Meerut.
7. Sharma O.P. (1992): A Text Book of Thallophytes, Tata McGraw Hill Publishing Co. New Delhi.
8. Mehrotra R.S. and K.R.Aneja (1990): Introduction to Mycology Wiley Eastern Ltd. New Delhi.
9. Pandey S.N.,P.S. Trivedi and S.P. Mishra: A Text Book of Botany Vol-I & II Vikas Publishing House, New Delhi.
10. Pandey B.P. (2000) College Botany Vol-I (Algae, Fungi, Bryophytes) S. Chand & Co. New Delhi.
11. Clinton A (1958) Introduction to Bacteria McMillan, New York.
12. Dubey H.C. (1982) Text Book of Fungi, Bacteria and Viruses, Vikas Publishing House, New Delhi.

Website Sources:

- www.kopykitab.com
- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- cqej.altopianoblu.it › botany-notes-pdf
- www.kalyanipublication.co.in
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›
- www.pdf.com
- en.wikipedia.org
- onlinecourses.nptel.ac.in
- www.yourarticlelibrary.com
- www.freebookcentre.net

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-I Year (I Semester)

BBO (H)-102: ALGAE AND BRYOPHYTES

Objective: The course aims to have the understanding of classification, diversity, vegetative growth, reproduction methods algae and Bryophytes, their affinities, evolution of bryophytes and economic as well as ecological importance of both groups of plants.

UNIT-I **(08 Sessions)**

General account of algae and their classification (based on F. E. Fritsch 1935)

Range of thallus in algae.

Flagellation, Pigmentation and Reproduction in algae.

UNIT-II **(08 Sessions)**

Structure, reproduction and graphic life cycle with alternation of generation of the following algal types:

- Chlorophyceae – *Chlamydomonas, Volvox, Vaucheria, Chara*
- Phaeophyceae – *Ectocarpus*
- Rhodophyceae – *Polysiphonia*.

Economic importance of algae.

UNIT-III **(08 Sessions)**

Bryophytes: general characters, classification (as given by Rothmaler),

Reproduction and affinities.

UNIT-IV **(08 Sessions)**

Systematic position, occurrence, thallus structure (external and internal), vegetative reproduction, asexual reproduction, sexual reproduction and graphic life cycle with alternation of generation of the following types (Developmental stages not required):

- Hepaticopsida – *Riccia, Marchantia*
- Anthocerotopsida – *Anthoceros*
- Bryopsida – *Funaria*

UNIT-V **(08 Sessions)**

Evolution of sporophyte in Bryophytes.

Economic importance of Bryophytes.

Course Outcomes:

Students completing this course will able to:

- Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae.
- Understand the diversity of algae, and evolution of bryophytes.
- Have the knowledge of economic and ecological significance of both plant groups.
- It will help to understand the comparison between algae and bryophytes.

Suggested Readings:

1. Ganguly and Kar. College Botany Vo. II. Calcutta
2. Khan, M.1983: Fundamentals of Phycology. Bishen Singh Mahendra Pal Singh, Dehradun
3. Parihar, N.S. The Biology and Morphology of Bryophytes, Central Book Depo. Allahabad.
4. Puri, P. 1980. Bryophytes. Atma Ram & Sons, Delhi.
5. Sharma, O.P. A Text Book of Bryophyta.
6. Singh, V., Pandey, P.C. and Jain, D.K. A text book of botany
7. Vashishta, B.R. Text Book of Algae. New Delhi
8. Parihar, N.S. 1996: Biology & Morphology of Pteridophytes. Central Book Depot, Allahabad.
9. Smith G.M. (1971): Cryptogamic Botany Vol-I. Algae and Fungi Tata McGraw Hill Publishing Co. New Delhi.

10. Smith G.M. (1971): Cryptogamic Botany Vol-II Bryophytes and Pteridophytes Tata McGraw Hill Publishing Co. New Delhi.
11. Vashishta B.R. (1990): Botany for Degree Students Part-I Algae, S. Chand & Co. New Delhi.
12. Vashishta B.R. (1990): Botany for Degree Students Part-III Bryophyta S. Chand & Co. New Delhi.
13. Fritsch F.E.(1945): The Structure and Reproduction of Algae Vol- I & II. Cambridge University Press.
14. Chapman V.J. and D.J. Chapman (1962): The Algae, English Language Book Society McMillan, London.

Website Sources:

- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- cqej.altopianoblu.it > botany-notes-pdf
- www.kalyanipublication.co.in
- www1.biologie.uni-hamburg.de
- www.freebookcentre.net
- <https://www.easybiologyclass.com>

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-I Year (I Semester)

BBO (H) -151: BOTANY LAB-1

Objective: The main goal of this course is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments:

(24 Sessions)

1. To stain and study bacteria
2. Fungi: Study of thallus structures of different fungi through preparation of whole mounts and sections: *Albugo, Puccinia, Agaricus, Alternaria and Cercospora*
3. Algae: Study of thallus structures of different groups of algae:
 - Chlorophyceae – *Chlamydomonas, Volvox, Vaucheria, Chara*
 - Phaeophyceae – *Ectocarpus*
 - Rhodophyceae – *Polysiphonia*
4. Bryophytes: study of morphology and anatomy of thallus of different bryophytes with their suitable diagrams:
 - Hepaticopsida – *Riccia, Marchantia*
 - Anthocerotopsida – *Anthoceros*
 - Bryopsida – *Funari*

Course Outcomes:

Completing this course, students will be able to:

- Culture the different bacterial strains and isolate them from environmental conditions.
- Have the knowledge of Gram staining technique.
- Gain knowledge on fixation, dehydration, hand sectioning, microtome sectioning.
- Observe and identify the algae and fungi.

Suggested Readings:

1. Botany Practical Vol. I by B.P. Pandey
2. A text Book of Practical Botany 1 by Bendre and Kumar
3. Practical Botany II by O.P. Sharma

Website Sources:

- <https://oer.galileo.usg.edu>
- <http://www.biologycorner.com>

- **Note: Latest editions of all the suggested readings must be used.**

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-I Year (II Semester)

BBO (H)-201: PTERIDOPHYTES, GYMNOSPERM AND PALAEOBOTANY

Objective: This course aims to familiarize the students with distribution, morphology and anatomy of pteridophytes and gymnosperms. The specific objectives of this course are to study heterospory, seed habits and stellar evolution in pteridophytes, economic importance of pteridophytes and gymnosperms, and general account of palaeobotany.

UNIT-I **(06 Sessions)**

General feature of Pteridophytes and their classification according to Sporne.
Stelar systems in Pteridophytes.

UNIT-II **(10 Sessions)**

Systematic position, occurrence, anatomy and reproductive structures of following classes:

- Psilopsida: *Rhynia*
- Lycopsida: *Selaginella*
- Sphenopsida: *Equisetum*
- Pterosida: *Marsilea*

Heterospory and seed habit.

UNIT-III **(06 Sessions)**

General features of Gymnosperms and their classification(Sporne)
Distribution of *Cycas* and *Pinus*

UNIT-IV **(08 Sessions)**

Morphology, anatomy and life cycle of *Cycas*, *Pinus* and *Taxus*
Economic importance of gymnosperms.

UNIT-V **(08 Sessions)**

General account of Palaeobotany and geological time scale.
Types of fossils and methods of fossilization

Course Outcomes:

Completing this course, the students will be able to:

- Describe the morphology and anatomy of the vascular cryptogams and gymnosperms.
- Enhance their knowledge about the economic and ecological importance of these plants.
- Study about the fossils, geological time scale etc.

Suggested Readings

1. Smith G.M. (1971) Cryptogamic Botany Vol-II Bryophytes and Pteridophytes Tata McGraw Hill Publishing Co. New Delhi.
2. Vashishta P.C. (1991) Botany for Degree Students Part-V Vascular Cryptogams (Pteridophyta) S. Chand & Co. New Delhi.
3. Sharma O.P. (1992) A Text Book of Pteridophytes McMillan (India) Ltd.
4. Pandey, S.N. A Text book of Pteridophyta
5. Parihar, N.S. 1996 Biology & Morphology of Pteridophytes. Central Book Depot, Allahabad
6. Vashishta, P.C. Text Book of Gymnosperm, S. Chand & Co. New Delhi.
7. Sharma, O.P. An Introduction to Gymnosperms, Pragati Prakashan, Meerut.
8. Singh, V., Pandey, P.C. and Jain, D.K. A text book of botany Rastogi Publication, Meerut.

Website Sources:

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- www.topfreebooks.org ›
- www.pdf.com
- en.wikipedia.org
- www.yourarticlelibrary.com
- www.freebookcentre.net

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BBO (H)-202: SYSTEMATICS OF FLOWERING PLANTS AND ECONOMIC BOTANY

Objective: The objective of this course is to enhance the knowledge of the students about the flowering plants, their classification, nomenclature, herbarium and botanical gardens. The students will also learn about the botanical description, cultivation and economic importance of some food crops, oil yielding plants, fiber yielding plants, medicinal plants and timber yielding plants.

UNIT-I **(08 Sessions)**

Binomial nomenclature, ICBN and its importance in modern plant taxonomy.
Bentham and Hooker's system of classification; Principles, outline, merits and demerits.
Herbarium & its techniques; important Herbaria and Botanic Gardens.

UNIT-II **(10 Sessions)**

Systematic position, distinguishing characters and economic importance of the following families:

Dicotyledons:

Polypetalae: Ranunculaceae, Malvaceae, Brassicaceae, Fabaceae, Cucurbitaceae and Umbelliferae (Apiaceae).

Gamopetalae: Compositae (Asteraceae), Solanaceae, Apocynaceae, Asclepiadaceae and Labiatae (Lamiaceae).

UNIT-III **(06 Sessions)**

Monochlamydae: Euphorbiaceae & Amaranthaceae

Monocotyledons: Palmae (Arecaceae), Graminae (Poaceae).

UNIT-IV **(10 Sessions)**

Economic importance with special reference to plants yielding:

Food: Cereals (Rice, Wheat & Maize); Millets (Pearl millet and Jowar); Potato, Sugarcane; Legumes (Soybean, Gram & Pea); Oil Yielding Plants (Mustard, Sunflower, Groundnut & Coconut).

Common fiber yielding plants: Cotton, Hemp, Sun-hemp, Flax, Jute, Coir and Ramie.

UNIT-V **(08 Sessions)**

Medicinal Plants: Poppy, Serpgandha, Ashwagandha and Gheekwar.

Timber yielding plants: Shisham, Sal, Teak and Babul.

Course Outcomes:

Students who successfully complete this course will be able to:

- What is the role of ICBN in plant taxonomy? what are different data sources in systematics?
- What are different methods of naming plants? What are different principles of nomenclature? Why name changes?
- What are artificial, natural and phylogenetic systems of classification?
- What are different methods of collecting and preserving plants? What is the importance of maintaining plants in botanic gardens?
- Comparison among different flowering plants groups.
- Learn the importance of plant of different plants.

Suggested Readings:

1. Angiosperm Phylogeny Group (2003). An update of the Angiosperm Phylogeny Group classification for the orders and families of the flowering plants: APG II. *Botanical Journal of the Linnean Society* 141: 399-436.
2. Crawford, D.J. (2003). *Plant Molecular Systematics*. Cambridge University Press, Cambridge, UK.
3. Cronquist, A. (1981). *An Integrated System of Classification of Flowering Plants*. Columbia University Press, New York.
4. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. and Donoghue, M.J. (2008). *Plant Systematics- A Phylogenetic Approach*. Sinauer Associates Inc, Massachusetts, USA.
5. Simpson, M.C. (2006). *Plant Systematics*. Elsevier, Amsterdam.
6. Stussy, T.F. 1990. *Plant Taxonomy*, Columbia University Press, USA.

7. A text book of Angiosperm, Singh, Pandey & Jain: Rastogi Publication, Meerut.
8. Kochhar, S.L. 2009 Economic Botany in Tropic. Macmillan and Co. New Delhi.
9. Wickens, G.E. 2004 Economic Botany: Principles and Practices, Springer. Kluwer Publishers, Dordrecht, The Netherlands.
10. Economic Botany, B. B. Pandey.
11. V.Verma. Economic Botany.
12. Saxena and Saxena, Plant taxonomy, Pragati Prakashan, Meerut.
13. Subramanyam and Sambamurti. Morphology and Taxonomy of Plants. Sri Sai Printography.

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- www1.biologie.uni-hamburg.de
- www.pdf.com
- en.wikipedia.org
- onlineecourses.nptel.ac.in
- www.yourarticlelibrary.com
- www.freebookcentre.net
- www.nativeplants.org

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-I Year (II Semester)

BBO (H)-251: Botany Lab-2

Objectives: The main Goal of this subject is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments:

(24 Sessions)

1. Study of following types with the help of specimens, photographs, section cutting and temporary slide preparations:
 - Pteridophytes: *Selaginella*, *Equisetum* & *Marsilea*.
 - Gymnosperm: *Cycas* & *Pinus* .
2. Angiosperm: Detailed description and identification of locally available wild plants of the families: Ranunculaceae, Brassicaceae, Rosaceae, Umbelliferae (Apiaceae), Compositae (Asteraceae), Solanaceae, Apocynaceae, Asclpiadaceae, Labiatae (Lamiaceae), Euphorbiaceae and Graminae (Poaceae).
3. Economic Botany: Identification and comment on the plant products as prescribed in theory course.
4. Submission of Herbarium collection of atleast 25 local wild plants.

Course Outcomes:

Completing this course, students will be able to:

- Gain knowledge on fixation, dehydration, hand sectioning, microtome sectioning.
- Observe and identify the Pteridophytes, Gymnosperms and Flowering Plants.
- Develop the skill of collection and preservation of plant specimens.
- Study the different food crops, plants fibers, medicinal plants and timber yielding plants.

Suggested Reading:

- Practical Botany II by O.P Sharma
- A text Book of Practical Botany2 by Bendre and Kumar
- Modern Practical Botany Vol. III by B.P. Pandey

Website Sources:

- <https://oer.galileo.usg.edu>
- <http://www.biologycorner.com>

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-II Year (III Semester)

BBO (H)-301: SEXUAL REPRODUCTION IN FLOWERING PLANTS

Objective: This course aims to expose the students to the following topics:

- Students should understand complete details about the structures, development of embryo at different stages including gametogenesis, fertilization, and implantation.
- Ability to correlate between the embryological structure and its significance.
- Introduce with seed and fruit development, apomixes, polyembryony and parthenocarpy.

UNIT-I **(08 Sessions)**
Microsporangium (anther wall, sporogenous tissue), Microsporogenesis and development of male gametophyte.

UNIT-II **(08 Sessions)**
Megasporangium (types of ovules, integuments, nucellus), Megasporeogenesis and development of female Gametophyte; types of embryosac, structure of mature embryo sac.

UNIT-III **(10 Sessions)**
Pollination (anther dehiscence and transfer of pollens), types of pollination, agencies of pollination. Fertilization and double fertilization.

UNIT-IV **(06 Sessions)**
Endosperm and its types, xenia and metaxenia.
Structure of dicot and monocot embryos.

UNIT-V **(06 Sessions)**
Formation of seed and fruit.
Apomixis; Polyembryony and Parthenocarpy.

Course Outcomes:

Completing this course, students will be able to:

- Understand the structure of male and female reproductive bodies in flowering plants.
- Familiarize to pollination processes.
- Learn about double fertilization and their significance
- Know about the structure and development of dicot and monocot embryos.
- Understand apomixes, polyembryony and parthenocarpy.

Suggested Reading:

1. Bhojwani, S. S. and Bhatnagar, S. P. 2000: the Embryology of Angiosperms, 4th, revised and enlarged edition. Vikas Publishing House, Delhi.
2. Maheshwari P. (1972) An Introduction to Embryology of Angiosperms Tata Mc Graw Hill Book Pub. Co. Ltd. New York.
3. B. P. Pandey: A text book of Angiosperms, S. Chand & Company, N. Delhi.
4. Singh, Pandey & Jain. Angiosperm, Rastogi Publication, Meerut.

Website Sources:

- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›
- <https://sites.google.com/>
- www.pdfdrive.com/botany-books.html
- <https://gurukpo.com>
- <http://www.brainkart.com>

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-II Year (III Semester)

BBO (H)-302: PLANT ANATOMY

Objective: This course aims to study the cellular structures and their role in plant development, tissues system, Water and food conducting elements, secondary growth in plants. The other objective of this course is to create understanding of leaf abscission and healing of wounds.

UNIT-I **(08 Sessions)**

Meristem and its classification based on position and origin.

Organization of root and shoot apices: Apical cell theory, Histogen theory & Tunica- carpus theory.

UNIT-II **(08 Sessions)**

Tissues: Simple tissues (Parenchyma, Collenchyma & Sclerenchyma); Complex tissues (Xylem & Phloem) and Secretory Tissues.

UNIT-III **(08 Sessions)**

Anatomy of stems with special reference to plants showing primary anomalies: *Nyctanthes*, *Bougainvillea*, *Amaranthus* & *Leptadenia*.

UNIT-IV **(06 Sessions)**

Normal secondary growth in dicot stem and dicot root.

Leaf abscission and healing of wounds.

UNIT-V **(08 Sessions)**

Anomalous secondary growth in dicot stem and monocot stem: *Bignonia*, *Salvadora*, *Boerhaavia* & *Dracaena*.

Course Outcome:

Students who successfully complete this course will be able to:

- Understand the meristems and role in plant development.
- Draw and explain the structures of various tissues in plants and their functions.
- Know how the secondary growth takes place in some dicot stem.
- Understand the process of abscission and healing of wounds

Suggested Reading:

1. Cutter, E. G. 1971: Plant Anatomy: Experiment and Interpretation. Part II. Organs. Edward Arnold, London.
2. Dickinson, W.C. 2000 Integrative Plant Anatomy. Harcourt Academic Press, USA.
3. Fahn, A. 1974 Plant Anatomy. Pergmon Press, USA and UK.
4. Mauseth, J.D. 1988 Plant Anatomy. The Benjamin/Cummings Publisher, USA.
5. Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers.
6. Sundara Rajan (1998) College Botany Vol-1 and Vol-2 Himalaya Publication House, Nagpur.
7. Dutta A.C. (1968) A Botany for Degree Students Oxford Press, London.
8. Tayal M.S. (1983) Plant Anatomy Rastogi Publication, Meerut.
9. Ganguli, Das, Dutta (1981) College Botany Vol-1 and Vol-2 New Central Book Agency, Kolkata.
10. Pandey B.P. (1993) Plant Anatomy S. Chand & Co. Pvt. Ltd.
11. Singh V, Pande P.C. & D.K. Jain (1994) Anatomy of Seed Plants Rastogi Publication, Meerut.
12. P.C. Vashishtha. Plant Anatomy. S. Chand & Co.

Website Sources:

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- www.pdfdrive.com/botany-books.html
- <https://gurukpo.com>
- <http://www.brainkart.com>

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B. Sc. (Hons.) Botany-II Year (III Semester)

BBO (H)-351: BOTANY LAB-3

Objectives: The main Goal of this subject is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments:

1. Embryology: (12 Sessions)

- Study of pollinia in *Calotropis* flower.
- Study of permanent slides – L. S. of ovule types,
- T. S. of anther; Germinating pollen,
- Embryosac Polygonum type.
- T. S. of ovary showing placentations, Dicot and Monocot Embryos.

2. Plant Anatomy: Anatomy of following stems: *Nyctanthes, Bougainvillea, Amaranthus, Bignonia, Mirabilis, Salvadoria, Leptadenia, Boerhaavia & Dracaena.* (12 Sessions)

Course Outcomes:

Completing this course, students will be able to:

- Dissect out the pollinia from *Calotropis procera* flower and explain the structure.
- Explain the T.S. of anther of *Datura*.
- Understand the types of placentation in different flower bud practically and physically.
- Gain knowledge on fixation, dehydration, hand sectioning, microtome sectioning of dicot and monocot stem.

Suggested Reading:

1. Practical Botany II by O.P Sharma
2. A text Book of Practical Botany2 by Bendre and Kumar
3. Modern Practical Botany Vol. III by B.P. Pandey

Website Sources:

- <https://oer.galileo.usg.edu>
- <http://www.biologycorner.com>

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IFTM University, Moradabad
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B. Sc. (Hons.) Botany-II Year (IV Semester)

BBO (H)-401: CELL AND MOLECULAR BIOLOGY

Objective: This course aims to introduce the students with prokaryotic and eukaryotic cell, ultra structures and function of cell organelles, morphology and chemistry of chromosomes, cell cycle, and nucleic acid as genetic material as well as replication of DNA.

UNIT-I **(08 Sessions)**
Prokaryotic and eukaryotic cell; differences between plant cell and animal cell; ultrastructure of typical plant cell. Ultrastructures and functions of cell organelles: Nucleus, chloroplast, mitochondria, golgi complex, endoplasmic reticulum and ribosomes.

UNIT-II **(08 Sessions)**
Morphology and chemistry of chromosomes; Giant chromosomes-Polytene and Lampbrush Chromosomes. Euchromatin and heterochromatin.

UNIT-III **(06 Sessions)**
Cell cycle: mitosis; meiosis and their significance. Comparison of meiosis and mitosis.

UNIT-IV **(10 Sessions)**
Nucleic acids as genetic material (Avery et al. and Hershey and Chase experiments; Fraenkel Conrat's expt. with TMV); Structure of nucleic acids; A, B, C & Z DNAs; genetic and non genetic RNAs. Chemistry of DNA synthesis (Kornberg's discovery); General principles – bidirectional, semi conservative and semi discontinuous replication, RNA priming; various models of DNA replication; Enzymes involved in DNA replication.

UNIT-V **(08 Sessions)**
Gene function: (a) Transcription; Genetic code and its properties
(b) Translation and termination of protein synthesis.
Gene regulation: Lac-operon model.

Course Outcomes:

On completion of the course, students will able to understand:

- Difference between prokaryotic eukaryotic cell and ultra structure of plant cell.
- Structure and functions of cell organelles.
- The eukaryotic cell cycle and mitotic and meiotic cell division.
- Structure and chemistry of chromosomes, types of chromosomes.
- Nucleic acid as genetic material, types of DNA, DNA replication and enzymes involved in DNA replication.

Suggested Reading:

1. Atherly, A.G. Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics, Saunders College Publishing, Fort Worth, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
3. Kleinsmith, L. J and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd edition) Harper Collins College Publishers, New York, USA.
4. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular, Cell Biology, W.H. Freeman and Co., New York., USA.
5. Russel, P.J. 1998. Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.
6. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley and Sons, Inc. USA.
7. P.S. Verma and V.K. Agarwal. Molecular Biology. S. Chand & Co., New Delhi.

Website Sources:

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- www.pdf.com
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- onlinecourses.nptel.ac.in
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- www.freebookcentre.net
- <https://gurukpo.com>

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IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-II Year (IV Semester)

BBO (H)-402: GENETICS, PLANT BREEDING AND BIOSTATISTICS

Objective: The objective of this course is to gain the understanding of students about mendelian concept, interaction of genes, linkage and crossing over, chromosomal aberrations and mutations.

This course also aims to understand the brief history of plant breeding and methods using plants breeding and role of statistics in plant breeding.

UNIT-I **(08 Sessions)**

Mendelism: Concept of dominance; genotype-phenotype concept, Mendel laws, incomplete dominance, test cross-back cross.

Interaction of genes: epistasis, supplementary and complementary

Linkage and Crossing over.

Cytoplasmic inheritance.

UNIT-II **(08 Sessions)**

Chromosomal aberrations (Deficiency; Duplication; Translocation ; Inversion) and numerical alterations in chromosomes (Aneuploidy and Euploidy with special reference to polyploids; autopolyploids & allopolyploids)

Mutation: spontaneous and induced mutation; methods of mutation and its significance in evolution.

UNIT-III **(08 Sessions)**

Aims and objectives of plant breeding; brief history of plant breeding.

Methods of plant breeding:

1. Selection
2. Hybridization
3. Plant introduction and acclimatization
4. Mutation breeding

UNIT-IV **(08 Sessions)**

Hybrid vigour (Heterosis) and its application.

Breeding for disease resistance

UNIT-V **(08 Sessions)**

Classification of data, mean, median and mode. Standard deviation, standard error, variance, co-relation, X^2 test and experimental designs.

Course Outcomes:

On completion of the course, students will able to:

- Explain the Mendelian inheritance, post mendelian inheritance and chromosomal aberration.
- Understand the science of plant breeding.
- Study the techniques of production of new superior crop varieties.
- Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, Pureline Selection and Clonal selection.
- Know about exploitation of heterosis, hybrid and variety development and their release through artificial hybridization.
- Understand various statistical methods of analysis.

Suggested Reading:

1. Atherly, A.g. Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics, Saunders College Publishing, Fort Worth, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molecular Biology. Rastogi Publications, Meerut, India
3. Kleinsmith, L.J. and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd edition). Harper Collins College Publishers, New York, USA.

4. Lodish, H., Berk, A., Zipursky, S.L., Matudaria, P., Baltimore, D. and Darnell, J. 2000.
5. Molecular, Cell Biology, W.H. Freeman and Co., New York, USA.
6. Russel, P.J. 1998. Genetics, The Benjamin/Cummings Publishing Co. Inc., USA.
7. Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics. John Wiley and Sons, Inc. USA.
8. Satish Kumar & Parul Tyagi. Plant Breeding and Biotechnology. Pragati Prakashan . Meerut.
9. P. K. Gupta. Evolution and Plant Breeding. Rastogi Publication, Meerut
10. B. D. Singh. Plant Breeding, Kalyani publication.
11. P.K. Benargee.: Biostatistics
12. R. Rangaswamy. Atext Book Of Agriculture Statistics
13. Radha Raman. Breeding of Horticulture Crops

Website Sources:

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- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›
- www.pdf.com
- en.wikipedia.org
- www.yourarticlelibrary.com
- www.freebookcentre.net

Note: Latest editions of all the suggested readings must be used.

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B. Sc. (Hons.) Botany-II Year (IV Semester)

BBO (H)-451: BOTANY LAB-4

Objective: The main Goal of this subject is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments:

(16 Sessions)

1. Preparation of mitotic and meiotic spreads and analysis of various stages of cell division (*Phlox and Allium*).
2. Isolation and purification of nuclei and their staining with Feulgen stain or DAPI.
3. Isolation of mitochondria and their visualization with Janus green B and mitotracker.
4. Isolation of chloroplasts
5. Extraction of genomic DNA from plants by CTAB method.
6. Numerical problems related to gene interaction and modified dihybrid ratio.
7. Plant breeding: emasculation technique.

Course Outcomes:

After successfully completing this course, the students will be able to:

- Understand the various stages occurred in mitotic and meiotic cell divisions.
- Apply quantitative problem-solving skills to genetics problems and issues.
- Select and apply experimental procedures to solve genetic problems.
- Perform the emasculation technique in various crop plants.
- Isolate and identify the plant DNA, chloroplast, mitochondria and nucleus.

Suggested Readings:

1. A text Book of Practical Botany 2 by Bendre and Kumar
2. Practical Biotechnology by R.S.Gaud.

Website Sources:

- <https://oer.galileo.usg.edu>
- <http://www.biologycorner.com>

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-III Year (V Semester)

BBO (H)-501: PLANT PHYSIOLOGY

Objective: This course aims to familiarize the students with various physiological processes, water absorption, transpirations, ascent of sap, photosynthesis and respiration. The main objective of this course is to understand the growth hormones and their role in plant's physiology.

UNIT-I **(08 Sessions)**
Water relation of plants: imbibitions, diffusion, osmosis, Plasmolysis, water potential, water absorption, loss of water and ascent of sap.
Mineral nutrition of plants: Physiological role and deficiency symptoms of micro and macronutrients.

UNIT-II **(08 Sessions)**
Photosynthesis: structure of chloroplast, absorption of light, transfer of light energy, electron transport, photophosphorylation, C₃, C₄, CAM pathways of carbon fixation.

UNIT-III **(08 Sessions)**
Transport of solutes: sugar translocation.
Respiration: aerobic and anaerobic, glycolysis. Krebs cycle, Electron Transport System (ETS), factors affecting respiration, respiratory quotient (RQ) and its measurement.

UNIT-IV **(10 Sessions)**
Plant growth hormones: physiological role of auxins, gibberellins, cytokinins, abscisic acid and ethylene.
Plant movements: movements of locomotion -spontaneous and induced (Tactic) and movements of curvature-spontaneous and induced (Tropic & Nastic).

UNIT-V **(08 Sessions)**
Physiology of flowering: photoperiodism and vernalization.
Seed dormancy and germination.

Course Outcomes:

On completion of the course, students will be able to:

- Understand the plants and plant cells in relation to water, the movement of sap and absorption of water in plant body.
- Know micro and macronutrients and their role in plant developments.
- Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C₃ and C₄ pathways.
- Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.
- Understand the plant movements, physiology of flowering, seed dormancy and germination.

Suggested Reading:

1. Hopkins, W.G. and Huner, P.A. 2008 Introduction to Plant Physiology. John Wiley and Sons.
2. Nelson, D.L., Cox, M.M. 2004 Lehninger Principles of Biochemistry, 4th edition, W.H. Freeman and Company, New York, USA.
3. Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wadsworth Publishing Co. Ltd.
4. Taiz, L. and Zeiger, E. 2006 Plant Physiology, 4th edition, Sinauer Associates Inc .MA, USA.
5. Dennis, D.T., Layzell, D.B., Lefebvre, D.D. and Turpin, D.H. (1997) Plant Metabolism. Addison Wesley Longman.
6. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.
7. S.K. Verma, A text book of Plant Physiology, Biochemistry & Biotechnology, S. Chand & Company.
8. H.N. Srivastava, Plant Physiology, Pradeep Publication, Jhalandhar
9. S.N. Pandey & B.K. Sinha, Plant Physiology, Vikas Publication, Delhi
10. C.P. Malik. Plant Physiology

Website Sources:

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- www.pdf.com
- en.wikipedia.org
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- www.freebookcentre.net

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
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B. Sc. (Hons.) Botany-III Year (V Semester)

BBO (H)-502: PLANT BIOCHEMISTRY

Objective: The main objective of this course to familiarize the students with enzymes, mechanism of enzymes, synthesis and biological role of ATP, Chemistry of Nucleic acid, general account of vitamins, biomolecules and their significance as well as nitrogen metabolism.

UNIT-I **(08 Sessions)**

Enzymes: classification, nomenclature, mechanism of action (binding to substrate, lowering of activation energy), factors controlling enzyme activity, Coenzymes.

ATP, its synthesis and biological role.

UNIT-II **(08 Sessions)**

Nucleic Acid: Introduction, Nitrogenous Bases, Chemistry of structure of Bases, Pentose sugar, Phosphoric acid; Nucleoside; Nucleotide; Structure of DNA; Mechanism of DNA replication in eukaryotes.

Vitamins: General account of water and fat soluble vitamins.

UNIT-III **(06 Sessions)**

Carbohydrates: Introduction, classification of carbohydrates, chemistry of monosaccharide; some important reactions of monosaccharides; Reducing and non-reducing sugar; significances of carbohydrates.

UNIT-IV **(08 Sessions)**

Proteins: Introduction; classification of protein; structure of protein-primary, secondary and tertiary; denaturation and renaturation of protein.

The Lipids: Introduction; Classification of lipids/fatty acids; properties of fatty acid and fats; waxes; Derived lipids (Steroids); importance of lipids.

UNIT-V **(06 Sessions)**

Nitrogen metabolism: N₂ fixation (Symbiotic and Asymbiotic); assimilation into Amino-acids.

Course Outcomes:

On completion of the course, students will be able to:

- Understand the structure and general features of enzymes, concept of enzyme activity and enzyme inhibition.
- Have the knowledge of DNA chemical constituents, and its replication.
- Understand the structure of biomolecules like carbohydrates, proteins, lipids and vitamins.
- Understand nitrogen metabolism in plants.

Suggested Readings:

1. Davies P J. (2004) Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands.
2. Jordan BR. (2006) The Molecular Biology and Biotechnology of Flowering, 2nd Edition, CAB International, Oxfordshire, U.K.
3. Lodish H, Berk A, Kaiser CA and Krieger M. (2008) Molecular Cell Biology, 6th Edition, W.H. Freeman and Company, New York, USA.
4. Lehninger (2004). Principles of Biochemistry, 4th Edition, Freeman and Company, New York, USA.
5. Taiz L and Zeiger E. (2006) Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA.
6. Jain, J. L. A text book of Biochemistry, S. Chand Publication, New Delhi.
7. Voet and Voet. Biochemistry. John Willey and Sons, Delhi.

Website Sources:

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Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-III Year (V Semester)

BBO (H)-503: STRESS BIOLOGY

Objective: The objective of present course is to educate the students about the stress, its types and how does it effect on the physiology of plants, defense mechanism against stresses and what is the role of Reactive oxygen species (ROS) in stress physiology.

UNIT-I **(06 Sessions)**

Defining plant stress: Acclimation and adaptation.

UNIT-II **(08 Sessions)**

Environmental factors: Water stress; Salinity stress, High light stress; Temperature stress; Hypersensitive reaction; Pathogenesis– related (PR) proteins; Systemic acquired resistance; Mediation of insect and disease resistance by jasmonates.

UNIT-III **(06 Sessions)**

Stress sensing mechanisms in plants: Calcium modulation, Phospholipid signaling.

UNIT-IV **(08 Sessions)**

Developmental and physiological mechanisms that protect plants against environmental stress: Adaptation in plants; Changes in root: shoot ratio; Aerenchyna development; Osmotic adjustment; Compatible solute production.

UNIT-V **(06 Sessions)**

Reactive oxygen species–Production and scavenging mechanisms.

Course Outcomes:

- On completing this course, the students will be able to understand:
- How does the stress the effect the physiology, morphology and anatomy of plants life?
- Resistant mechanism in plants.
- What is salinity stress?
- The role of ions in causing of salinity.
- The role of stressed hormones in plants.
- What is Reactive Oxygen Species(ROS) and what is the role of it in defense mechanism.

Suggested Readings:

1. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Salisbury, F.B. and Ross, C.W. 1991 Plant Physiology, Wadsworth Publishing Co. Ltd.
4. S.K. Verma, A text book of Plant Physiology, Biochemistry & Biotechnology, S. Chand & Company.
5. H.N. Srivastava, Plant Physiology, Pradeep Publication, Jhalandhar
6. S.N. Pandey & B.K. Sinha, Plant Physiology, Vikas Publication, Delhi
7. C.P. Malik. Plant PhysioloHy

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- www.pdf.com
- en.wikipedia.org

- www.yourarticlelibrary.com
- www.freebookcentre.net

Note: Latest editions of all the suggested readings must be used.

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Bachelor of Science (Honours) Botany Programme
B. Sc. (Hons.) Botany-III Year (V Semester)

BBO (H)-504: ANALYTICAL TECHNIQUES IN PLANT SCIENCES

Objective: The objective of this course is to provide knowledge on recent technological advances like molecular biology, biotechnology, plant physiology and biochemistry.

UNIT-I **(08 Sessions)**

Imaging and related techniques: Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

UNIT-II **(08 Sessions)**

Cell fractionation: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl₂ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Radioisotopes: Use in biological research, auto-radiography, pulse chase experiment.

UNIT-III **(08 Sessions)**

Spectrophotometry: Principle and its application in biological research.

Chromatography: Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

UNIT-IV **(08 Sessions)**

Characterization of proteins and nucleic acids: Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

UNIT-V **(08 Sessions)**

Biostatistics: Statistics, data, population, samples, parameters; Representation of Data: Tabular, Graphical; Measures of central tendency: Arithmetic mean, mode, median; Measures of dispersion: Range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Course Outcomes:

- On completing this course, the students will be able to:
- Learn the microscopy and its application; the different types of microscopes and what are uses of them in research?
- Understand cell fractionation by centrifugation.
- learn what are the radioisotopes and why they are used in research.
- Learn the spectrophotometry, chromatography and their types.
- Understand isolation techniques like Electrophoresis: AGE, PAGE, SDS-PAGE for analysis of DNA, RNA and proteins.
- Learn data analysis by mean mode median, graphic representation of the data.
- Know where mean deviation, variation, standard deviation; Chi-square test are used.

Suggested Readings:

1. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). Plant Microtechnique and Microscopy, Oxford University Press, New York. U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995).

- Short Protocols in Molecular Biology. John Wiley & Sons. 3rd edition.
- Zar, J.H. (2012). Biostatistical Analysis. Pearson Publication. U.S.A. 4th edition.

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- <http://onlinecourses.nptel.ac.in>
- <https://lab-training.com/>
- <https://www.omicsonline.org>
- <en.wikipedia.org>

Note: Latest editions of all the suggested readings must be used.

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
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BBO (H)-505: PLANT DIVERSITY AND HUMAN WELFARE

Objective: This course aims to learn the students about plant diversity, value and uses of diversity, Causes of loss of biodiversity, present scenario biodiversity loss, management system at national and international levels, conservation of biodiversity, and role plants in relation to human welfare.

UNIT-I

(08 Sessions)

Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agro-biodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

UNIT- II

(08 Sessions)

Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agro-biodiversity, projected scenario for biodiversity loss.

UNIT-III

(08 Sessions)

Management of Plant Biodiversity: Organizations associated with biodiversity management- Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information and communication.

UNIT-IV

(08 Sessions)

Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *in-situ* and *ex-situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

UNIT-V

(08 Sessions)

Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.

Course Outcomes:

- On completing this course, the students will be able to:
- Understand the concept and scope plant diversity.
- Learn about the causes and implication of loss of biodiversity.
- Develop their skill to manage the diversity of plans
- Utilizes many strategies for the conservation of biodiversity.
- Understand the role of plants in human welfare.

Suggested Readings:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi
1. Singh, J.S., Singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi
2. Abe, T., Levin, S. A. and Higashi, M. (1997) (ed.): Biodiversity an Ecological Perspective.

Website Sources:

- <https://onlinecourses.swyam2.ac.in/>
- <http://onlinecourses.nptel.ac.in>

- <https://lab-training.com/>
- <https://www.omicsonline.org>
- en.wikipedia.org

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BBO (H)-506: NURSERY AND GARDENING

Objective: The objective of this course is to develop the skill of nursery and gardening and learn how to seed is sowing, what are propagation methods? What is the use of computer in land scaping.

UNIT-I **(08 Sessions)**

Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.

UNIT-II **(08 Sessions)**

Seed: Structure and types - Seed dormancy; causes and methods of breaking dormancy - Seed storage: Seed banks, factors affecting seed viability, genetic erosion - Seed production technology - seed testing and certification.

UNIT-III **(08 Sessions)**

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings - Hardening of plants - green house - mist chamber, shed root, shade house and glass house.

UNIT-IV **(08 Sessions)**

Gardening: definition, objectives and scope - different types of gardening - landscape and home gardening - parks and its components - plant materials and design - computer applications in landscaping - Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

UNIT-V **(08 Sessions)**

Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables: cabbage, brinjal, lady's finger, onion, garlic, tomatoes, and carrots - Storage and marketing procedures.

Course Outcomes:

On completion of this course the students will be able to:

- Understand the process of sowing seeds in nursery
- Document the various resources required for the development of nursery
- Distinguish among the different forms of sowing and growing plants
- Analyse the process of vegetative propagation
- Appreciate the diversity of plants and selection of gardening
- Examine the cultivation of different vegetables and growth of plants in nursery and gardening

Suggested Readings:

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
4. Edmond Musser & Andres, Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.
5. Agrawal, P.K. 1993, Hand Book of Seed Technology, Dept. of Agriculture and
6. Cooperation, National Seed Corporation Ltd., New Delhi.
7. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San
8. Francisco, USA.

Website Sources:

- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›

- www.pdf.com
- en.wikipedia.org
- www.yourarticlelibrary.com
- www.freebookcentre.net

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BBO (H)-551: BOTANY LAB -5 A

Objective: The main Goal of this subject is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments: **(20 Sessions)**

1. Plant Physiology:

- i. Demonstration of Endosmosis, Exosmosis, Plasmolysis and Imbibition.
- ii. Measurement of transpiration, photosynthetic rate and R. Q. of different respiratory substrates.
- iii. Effect of temperature & light on the germination of seeds.

2. Biochemistry:

- i. Colour tests, microtests for carbohydrates, proteins and lipids.
- ii. Paper chromatography of chlorophyll pigments and amino-acids.
- iii. The study of Azolla and Rhizobium as biofertilizers.

Suggested Reading:

4. Practical Botany II by O.P Sharma
5. A text Book of Practical Botany2 by Bendre and Kumar
6. Modern Practical Botany Vol. III by B.P. Pandey

Website Sources:

- <https://oer.galileo.usg.edu>
- <http://www.biologycorner.com>

Note: Latest editions of all the suggested readings must be used.

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BBO (H)-552: BOTANY LAB-5 B

Objective: The main Goal of this subject is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments:

(24 Sessions)

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. To separate nitrogenous bases by paper chromatography.
3. To separate sugars by thin layer chromatography.
4. Isolation of chloroplasts by differential centrifugation.
5. To estimate protein concentration through Lowry's methods.
6. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH).
7. Preparation of permanent slides (double staining).
8. Quantitative estimation of peroxidase activity in the seedlings in the absence and presence of salt stress.
9. Superoxide activity in seedlings in the absence and presence of salt stress.
10. Zymographic analysis of peroxidase.
11. Zymographic analysis of superoxide dismutase activity.
12. Quantitative estimation and zymographic analysis of catalase.
13. Estimation of superoxide anions.

Course Outcomes:

- On completing this course, the students will be able to:
- Understand the blotting techniques, DNA fingerprinting and DNA sequencing.
- Estimate nitrogen bases, sugars by chromatography.
- Isolate the chlorophyll pigments.
- Estimate the protein by Lowry's method
- Analyze the different enzyme activity under stressed condition.

Suggested Reading:

1. Practical Agronomy by R. B. Tiwari
2. A text Book of Practical Botany² by Bendre and Kumar
3. Practical Biotechnology by R.S. Gaud
4. Practical Biochemistry by Keith Wilson
5. Practical Manual of Biochemistry by S.P. Singh

Website Sources:

- <https://onlinecourses.swayam2.ac.in/>
- <http://onlinecourses.nptel.ac.in>
- <https://lab-training.com/>
- <https://www.omicsonline.org>
- <en.wikipedia.org>

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BBO (H)-601: FUNDAMENTALS OF BIOTECHNOLOGY

Objective: This course aims to introduce to the students with basics concepts of biotechnology and its role in agriculture, medical field, functional foods and nutraceuticals.

UNIT-I **(08 Sessions)**
Introduction, Recombinant DNA technology: Restriction enzymes and cleavage; Agarose Gel Electrophoresis; Cloning vectors.

UNIT-II **(08 Sessions)**
Isolation of cellular DNA; Methods to obtain passenger DNA through genomic library, polymerase chain reaction; Ligation of passenger DNA into a vector.

UNIT-III **(06 Sessions)**
Transfer of recombinant DNA into bacterial cell (host); downstream processing.

UNIT-IV **(08 Sessions)**
Application of Biotechnology in agriculture; Pest resistant crops Bt crops, RNAi mediated crops; functional food and nutraceuticals.

UNIT-V **(08 Sessions)**
Herbicide resistant transgenic plants; transgenic microbes; medical applications; production of enzymes, vitamins and antibiotics.

Course Outcomes:

Students, who successfully complete this course will be able to:

- Describe bio-catalysis, pathway engineering, bioprocess control and downstream processing.
- Demonstrate their ability to reason both inductively and deductively with experimental information and data.
- Explain the theory and practice of recombinant DNA technology.
- Select and apply experimental procedures to the spectrum of fields making use of biotechnology.

Suggested Readings:

1. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
2. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
3. Chrispeel, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones and Barlett Publishers.
4. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
5. Smith, R. 2000 Plant Tissue Culture: Techniques and Experiments, 2nd edition, Academic.
6. Gardner, E.J. Simmonns, M.J. Snustad, D.P. 2008 8th edition Principles of Genetics. Wiley India.
7. Russell, P.J. 2009 Genetics – A Molecular Approach. 3rd edition. Benjamin Co.
8. Raven, P.H., Johnson, GB., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.
9. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.
10. Sambrook & Russel. Molecular Cloning: A Laboratory manual. (3rd edition)
11. B. D. Singh. Biotechnology. Kalyani Publications.
12. H. D. Kumar, Molecular Biology and Biotechnology, Vikas Publication, Delhi.
13. S. K. Verma. Plant Physiology, biochemistry & biotechnology. S. Chand & Co., New Delhi.
14. K. G. Ramawat. Plant Biotechnology, S. Chand & Co., New Delhi.

Website Sources:

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- www.topfreebooks.org ›
- www.pdf.com
- en.wikipedia.org
- www.yourarticlelibrary.com
- www.freebookcentre.net
- onlineecourses.nptel.ac.in

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BBO (H)-602: PLANT ECOLOGY

Objective: This course aims to familiarize the students with environment and its factors and to know the interrelationship between organisms in populations and communities and to aware the students regarding environmental issues and problems at local, national and international levels. The main theme of the study of plant ecology is to know the structure and functions of ecosystems,

UNIT-I **(10 Sessions)**

Introduction to Ecology: Definition; scope and importance; levels of organization.

Environment: Introduction; environmental factors- climatic (water, light, temperature), edaphic (soil profile, physico-chemical properties), topographic and biotic factors (species interaction).

UNIT-II **(08 Sessions)**

Ecosystem: Structure (components) and functions (trophic levels, food chains, food webs, ecological pyramids and energy flow)

Biogeochemical cycles: carbon and nitrogen; Phosphorus cycle.

UNIT-III **(08 Sessions)**

Plant adaptations: Xerophytes, Hydrophytes, Halophytes, mangrove vegetation and Epiphytes.

Ecological succession: Xerosere and Hydrosere, climax concept.

Ecological nich; genecology with reference to ecads and ecotypes

UNIT-IV **(06 Sessions)**

Phytogeography: Phytogeographical regions of India; vegetation types of India (forests).

UNIT-V **(08 Sessions)**

Environmental pollution: Sources, types and control of air and water pollution Global change: Greenhouse effect and greenhouse gases; impact of global warming.

Course Outcomes:

On completion this course, students will be able to:

- Explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment.
- Understand the effects of the physical features of the environment on the structure of populations, communities, and ecosystems.
- Describe the plant succession and plant adaptations.
- Understand the environmental pollution and its effects.

Suggested readings:

1. Odum, E.P. 1983: Basic Ecology, Saunders, Philadelphia.
2. Kormondy, E.J. 1996: Concepts of Ecology, Prantice-Hall of India Pvt. Ltd., New Delhi.
3. Mackenzie, A. et al. 1999: Instant Notes in Ecology, Viva Books Pvt. Ltd., New Delhi.
4. Joseph, B., Environmental studies, Tata Mc Graw Hill.
5. Chapman, J.L., Reiss, M.J. 1999. Ecology: Principles and applications (2nd edition) Cambridge University Press.
6. Sinha, S. 2010. Handbook on Wildlife Law Enforcement in India. TRAFFIC, India.
7. Singh, J.S., Singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi
8. Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach. Oxford.
9. Daubenmier, R.F. (1970). Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited
10. Daubenmier, R.F. (1970), Plant Communities, Wiley Eastern Private Limited.

13. Odum, E. (2008) Ecology. Oxford and IBH Publisher.
14. Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.
15. Shukla and Chandel; Ecology and Soil Science, S. Chand Publication,

Website Sources:

- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›
- www.pdf.com
- en.wikipedia.org
- www.yourarticlelibrary.com
- www.freebookcentre.net
- onlinecourses.nptel.ac.in

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BBO (H)-603: NATURAL RESOURCES MANAGEMENT

Objective: This course aims to familiarize the students with concepts of natural resources and their utilization, water resources, forest resources, energy resources and biological resources and the best practices of their management.

UNIT-I **(08 Sessions)**

Natural resources: Definition and types.

Sustainable utilization: Concept, approaches (economic, ecological and socio-cultural).

UNIT-II **(08 Sessions)**

Land: Utilization (agricultural, pastoral, horticultural, silvicultural); Soil degradation and management.

Water: Fresh water (rivers, lakes, groundwater, aquifers, watershed); Marine; Estuarine; Wetlands; Threats and management strategies.

UNIT-III **(08 Sessions)**

Biological Resources: Biodiversity-definition and types; Significance; Threats; Management strategies; Bio- prospecting; IPR; CBD; National Biodiversity Action Plan).

UNIT-IV **(08 Sessions)**

Forests: Definition, Cover and its significance (with special reference to India); Major and minor forest products; Depletion; Management.

Energy: Renewable and non-renewable sources of energy

UNIT-V **(08 Sessions)**

Contemporary practices in resource management: EIA, GIS, Participatory Resource Appraisal, Ecological Footprint with emphasis on carbon footprint, Resource Accounting; Waste management.

National and international efforts in resource management and conservation

Course Outcomes:

At the end of the course the students will be able to,

- Understand the concept of different natural resources and their utilization.
- Critically analyze the sustainable utilization land, water, forest and energy resources.
- Evaluate the management strategies of different natural resources.
- Reflect upon the different national and international efforts in resource management
- and their conservation

Suggested readings:

1. Vasudevan, N. (2006). Essentials of Environmental Science. Narosa Publishing House, New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
4. Rogers, P. P., Jalal, K. F. and Boyd, J. A. (2008). An introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

Website Sources:

- <https://onlinecourses.swayam2.ac.in/>
- <http://onlinecourses.nptel.ac.in>
- <https://lab-training.com/>
- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org >

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BBO (H)-604: RESEARCH METHODOLOGY

Objective: This course aims to enhance the research skill of the students.

UNIT-I **(08 Sessions)**

Basic concepts of research: Research-definition and types of research (Descriptive vs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs empirical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research.

UNIT-II **(08 Sessions)**

General laboratory practices: Common calculations in botany laboratories. Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

UNIT-III **(08 Sessions)**

Data collection and documentation of observations: Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissue specimens and application of scale bars. The art of field photography.

UNIT-IV **(08 Sessions)**

Overview of Biological Problems: History; Key biology research areas, Model organisms in biology (A Brief overview): Genetics, Physiology, Biochemistry, Molecular Biology, Cell Biology, Genomics, Proteomics- Transcriptional regulatory network.

UNIT-V **(10 Sessions)**

Methods to study plant cell/tissue structure: Whole mounts, peel mounts, squash preparations, clearing, maceration and sectioning; Tissue preparation: living vs fixed, physical vs chemical fixation, coagulating fixatives, non-coagulant fixatives; tissue dehydration using graded solvent series; Paraffin and plastic infiltration; Preparation of thin and ultrathin sections.

The art of scientific writing and its presentation: Numbers, units, abbreviations and nomenclature used in scientific writing. Writing references. Powerpoint presentation. Poster presentation. Scientific writing and ethics, Introduction to copyright-academic misconduct/plagiarism.

Course Outcomes:

- Understand the concept of research and different types of research in the context of plant science.
- Enhance laboratory experiment related skill.
- Develop competence on data collection and process of scientific documentation.
- Analysis of ethical aspects of research
- Evaluate the different methods of scientific writing and reporting.

Suggested readings:

1. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
2. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
3. Ruzin, S.E. (1999). Plant microtechnique and microscopy. Oxford University Press, New York, U.S.A.

Website Sources:

- <https://onlinecourses.swayam2.ac.in/>
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- <https://lab-training.com/>
- <https://www.omicsonline.org>
- <en.wikipedia.org>
- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›

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BBO (H)-605: ETHNOBOTANY

Objective: This course aims to expose to the students of following points:

- Introduction, concept and scope of Ethnobotany.
- What methods would be used to ethno botanical studies.
- Learn the role of Ethnobotany in modern medicine with special reference to some plants.
- Legals aspects of protection of plant wealth, biopiracy and intellectual property rights and traditional knowledge.

UNIT-I

(10 Sessions)

Ethnobotany: Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

UNIT-II

(08 Sessions)

Methodology of Ethnobotanical studies: a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

UNIT-III

(08 Sessions)

Role of ethnobotany in modern Medicine: Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*.

UNIT-IV

(08 Sessions)

Role of ethnobotany in modern medicine with special example *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).

UNIT-V

(08 Sessions)

Ethnobotany and legal aspects: Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

Course Outcomes:

On completion of this course, the students will be able to:

- Conceptualize ethnobotany as an interdisciplinary science
- Restate the established methodology of ethnobotany studies
- Categories various indigenous ethnic groups and their environmental practices.
- Understand the legalities associated with ethnobotany.

Suggested Readings

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
3. Lone et al., Palaeoethnobotany
4. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
5. S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
6. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
7. Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
8. 8 Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur-1996
9. 9 Faulks, P.J. 1958. An introduction to Ethnobotany, Moredale pub. Ltd.

Website Sources:

- <https://onlinecourses.swayam2.ac.in/>
- <http://onlinecourses.nptel.ac.in>
- <https://lab-training.com/>
- <https://www.omicsonline.org>
- <en.wikipedia.org>
- www.pdfdrive.com/botany-books.html
- www.digitalbookindex.org
- www1.biologie.uni-hamburg.de
- www.topfreebooks.org ›

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BBO (H)-651: BOTANY LAB-6

Objective: The main Goal of this subject is to share the knowledge to the students about the experiments. The students will get a better understanding of the concept studied by them in theory course and correlate with experimental observations.

List of Experiments: (20 Sessions)

Biotechnology:

1. Plasmid DNA isolation: Miniprep
2. Agrose gel electrophoresis of isolated plasmid.

Ecology:

1. Study of vegetation by Quadrat method; study of parameters such as – Density, abundance, Frequency and Relative Frequency.
2. Study of morphology and anatomy of hydrophytes, Xerophytes and Halophytes.
3. Study of polluted water and saline water on seed germination and seedling growth of a given crop.
4. Identification of Soil texture - clay, sand, loamy.
5. Measurement of pH of soil using pH meter.
6. Study of water holding capacity of different soils.
7. Study of qualitative presence of CO₃, NO₃, SO₄ & Cl in soil.

Course Outcomes:

On completing this course, the students will be able to:

- Isolate plasmid DNA
- Know the practical aspects of Agrose gel electrophoresis
- Find out Density, abundance, Frequency and Relative Frequency of plant species in given area by quadrat method.
- Know what effects of polluted water and saline water are on seed germination and seedling growth.
- Find out water holding capacity and qualitative presence of some mineral ions.
- Identify the hydrophytes, xerophytes and halophytes on the basis of their morphological and anatomical features.

Suggested Reading:

1. Practical Agronomy by R. B. Tiwari
2. A text Book of Practical Botany² by Bendre and Kumar
3. Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.
4. Shukla and Chandel; Ecology and Soil Science, S. Chand Publication,

Website Sources:

- <https://onlinecourses.swayam2.ac.in/>
- <http://onlinecourses.nptel.ac.in>
- <https://lab-training.com/>
- <https://www.omicsonline.org>
- www.pdfdrive.com/botany-books.html

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BBO (H) -652: PROJECT/DISSERTATION

Objective: The objective of this advanced course is to provide students with hands-on training in specialized areas of plant sciences.

Contents:

(42 Sessions)

Project / Dissertation will be prepared based on subjects studied by the students in any semester of course. This will help the students how to prepare themselves for the research work for further studies.

Course Learning Outcomes:

Students will acquire the following:

1. Training in experimental design and execution
2. Knowledge on techniques and tools of research
3. Quantitative and qualitative data analysis
4. Analysis and interpretation of data in the perspective of existing knowledge

Website Sources:

- <https://onlinecourses.swayam2.ac.in/>
- <http://onlinecourses.nptel.ac.in>
- <https://lab-training.com/>
- <https://www.omicsonline.org>
- www.pdfdrive.com/botany-books.html

Note: Latest editions of all the suggested readings must be used