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

BBOCC (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 for skill development.

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) for skill development.

UNIT-II **(06 Sessions)**

Role of bacteria and cyanobacteria in agriculture.
Microorganisms and the production of alcoholic beverages, antibiotics and single cell protein for skill development.

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 for skill development.

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 for skill development:

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 for skill development.

Course Outcomes:
Students completing this course will able to:

CO1 Understand the diversity of micro-organisms such as viruses, bacteria, fungi lichens, their classification, structure and growth for enhancement of global knowledge

CO2 Increase the understanding the economic values of bacteria, fungi, mycorrhizae, lichens and develop theoretical & technical skills about them for enhancement of global knowledge

CO3 Develop conceptual skill about identifying microbes, pathogens, biofertilizers &lichens for skill development.

CO4 Learn host –pathogen relationship and disease management for skill development at local level.

CO5 Understand the structure and reproduction of certain selected bacteria algae, fungi and lichens for skill development at national level.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	2	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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. Clintion 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:

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- 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)

BBOCC (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 for skill development.

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 for skill development.

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 for skill development.

UNIT-III **(08 Sessions)**

Bryophytes: general characters, classification (as given by Rothmaler),
Reproduction and affinities for skill development.

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) for skill development:

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

UNIT-V **(08 Sessions)**

Evolution of sporophyte in Bryophytes for skill development.
Economic importance of Bryophytes.

Course Outcomes:
Students completing this course will able to:

CO1 Learn about the structure, pigmentation, food reserves and methods of reproduction of Algae for enhancement of global knowledge.

CO2 Understand the diversity of algae, and evolution of bryophytes for skill development.

CO3 Have the knowledge of economic and ecological significance of both plant groups for enhancement of global knowledge.

CO4 It will help to understand the comparison between algae and bryophytes for skill development.

CO5 Have the knowledge of evolution of bryophytes, economic and ecological significance of bryophytes for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	2	1	2	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	2	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1
CO5	3	2	1

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:

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- 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)

BBOCC (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 for skill development and enterpreurship.

List of Experiments: **(24Sessions)**

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 – *Funaria*

Course Outcomes:
Completing this course, students will be able to:

CO1 Culture the different bacterial strains and isolate them from environmental conditions for enhancement of global knowledge and enterpreurship.

CO2 Have the knowledge of Gram staining technique for enhancement of global knowledge and enterpreurship.

CO3 Gain knowledge on fixation, dehydration, hand sectioning, microtome sectioning for skill development and enterpreurship

CO4 Observe and identify the algae and fungi for enhancement of global knowledge and enterpreurship.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	1	1	3	1	1	1	1	1	3
CO2	1	3	1	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	2	2	3	3
CO4	1	1	3	1	1	1	1	3	2	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1

Suggested Readings:

1. Botany Practical Vol. I by B.P. Pandey
2. A text Book of Practical Botany 1by 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)

BBOCC (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 Paleaobotany for skill development.

UNIT-I **(06 Sessions)**
General feature of Pteridophytes and their classification according to Sporne.
Stelar systems in Pteridophytes for skill development.

UNIT-II **(10 Sessions)**
Systematic position, occurrence, anatomy and reproductive structures of following classes for skill development:

- 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* for skill development

UNIT-IV **(08 Sessions)**
Morphology, anatomy and life cycle of *Cycas, Pinus and Taxus*
Economic importance of gymnosperm**s** for skill development.

UNIT-V **(08 Sessions)**
General account of Palaeobotany and geological time scale.
Types of fossils and methods of fossilization for skill development.

Course Outcomes:
Completing this course, the students will be able to:

CO1 Describe the morphology and anatomy of the local vascular cryptogams and gymnosperms for skill development.
CO2 Have understanding on evolution and affinities of Pteridophytes
CO3 Have understanding on evolution and affinities of Gymnosperms for skill development at global level.
CO4 Enhance global knowledge about the economic and ecological importance of these plants for skill development.
CO5 Study about the fossils, geological time scale etc for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	3	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	3	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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, PragatiPrakashan, Meerut.
8. Singh, V., Pandey, P.C. and Jain, D.K. A text book of botany Rastogi Publication, Meerut.

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- 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 (II Semester)

BBOCC (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 for skill development.

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 for skill development.

UNIT-II **(10 Sessions)**

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

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 for skill development.
Monocotyledons: Palmae (Arecaceae), Graminae (Poaceae).

UNIT-IV **(10 Sessions)**

Economic importance with special reference to plants yielding for skill development:

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 for skill development.
Timber yielding plants: Shisham, Sal, Teak and Babul.

Course Outcomes:

Students who successfully complete this course will be able to:

CO1 What is the role of ICBN in plant taxonomy? What are different data sources in systematics? It provides skill development at global level.

CO2 What are different methods of naming plants? What are different principles of nomenclature? Why name changes? It provides skill development.

CO3 What are artificial, natural and phylogenetic systems of classification? It provides skill development for at global level.

CO4 What are different methods of collecting and preserving plants? What is the importance of maintaining plants in botanic gardens? It provides skill development

CO5 Learn the importance of plant of different plants. It provides skill development at national level.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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 Linnaean 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. Sinaner 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. Klwer Publishers, Dordrecht, The Netherlands.
10. Economic Botany, B. B. Pandey.
11. V.Verma. Economic Botany.
12. Saxena and Saxena, Plant taxonomy, PragatiPrakashan, Meerut.
13. Subramanyam and Sambamurti. Morphology and Taxonomy of Plants. Sri Sai Printography.

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- www.pdfdrive.com/botany-books.html
- *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. (Honours) Botany-I Year (II Semester)

BBOCC (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 for enhancing skills.

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:

CO1 Gain knowledge on fixation, dehydration, hand sectioning, microtome sectioning for skill development at global level.

CO2 Observe and identify the Pteridophytes, Gymnosperms and Flowering Plants for skill development.

CO3 Develop the skill of collection and preservation of plant specimens at local level for skill development.

CO4 Study the different food crops, plants fibers, medicinal plants and timber yielding plants at local level for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	2	1	1	1	3
CO2	1	3	2	1	1	3	1	2	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1

Suggested Readings:

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

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

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

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

Objective: This course aims to expose the students to the following topics for skill development:

- 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 for skill development.

UNIT-II **(08 Sessions)**

Megasporangium (types of ovules, integuments, nucellus), Megasporogenesis and development of female Gametophyte; types of embryosac, structure of mature embryo sac for skill development.

UNIT-III **(10 Sessions)**

Pollination (anther dehiscence and transfer of pollens), types of pollination, agencies of pollination.
Fertilization and double fertilization for skill development.

UNIT-IV **(06 Sessions)**

Endosperm and its types, xenia and metaxenia.
Structure of dicot and monocot embryos for skill development.

UNIT-V **(06 Sessions)**

Formation of seed and fruit.
Apomixis; Polyembryony and Parthenocarpy for skill development.

Course Outcomes:
Completing this course, students will be able to:

CO1 Understand the structure of male and female reproductive bodies in flowering plants for enhancement of global knowledge.

CO2 Familiarize to pollination processes for skill development at local level.

CO3 Learn about double fertilization and their significance for skill development.

CO4 Know about the structure and development of dicot and monocot embryos.

CO5 Understand apomixes, polyembryony and parthenocarpy for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	1	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	2	1	1	1	2	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	2	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

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 AngiospermsTata 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.

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- 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. (Honours) Botany-II Year (III Semester)

BBOCC (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 for skill development.

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 for skill development.

UNIT-II **(08 Sessions)**

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

UNIT-III **(08 Sessions)**

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

UNIT-IV **(06 Sessions)**

Normal secondary growth in dicot stem and dicot root.

Leaf abscission and healing of wounds for skill development.

UNIT-V **(08 Sessions)**

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

Course Outcomes:

Students who successfully complete this course will be able to:

CO1 Understand the meristems and role in plant development for skill development at local level.

CO2 Draw and ex-plain the structures of various tissues in plants and their functions for skill development.

CO3 Understand the meristems and role in plant development; primary structure of root, stem and leaf for skill development at local level.

CO4 Know how the secondary growth takes place in some dicot stem for skill development at local level.

CO5 Understand the process of abscission and healing of wounds for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

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 Benjammin/Cummings Publisher, USA.
5. Esau, K. 1977 Anatomy of Seed Plants. Wiley Publishers.
6. SundaraRajan (1998) College Botany Vol-1 and Vol-2 Himalaya Publication House, Nagpur.
7. Dutta A.C. (1968) A Botany for Degree Students Oxford Press, Londan.
8. Tayal M.S. (1983) Plant Anatomy Rastogi Publication, Meerut.
9. Ganguli, Das, Dutta (1981) College Botany Vol-1 and Vol-2 New Cenral Book Agency, Kolkatta.
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.

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- 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. (Honours) Botany-II Year (III Semester)

BBOCC (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 for skill development.

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,
   - EmbryosacPolygonum type.
   - T. S. of ovary showing placentations, Dicot and Monocot Embryos.

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

Course Outcomes:

Completing this course, students will be able to:

CO1 Dissect out the pollinia from *Calotropis procera* flower and explain the structure for enhancement of global knowledge.

CO2 Explain the T.S. of anther of Datura for skill development.

CO3 Understand the types of placentation in different flower bud practically and physically for enhancement of global knowledge

CO4 Gain knowledge on fixation, dehydration, hand sectioning, microtome sectioning of dicot and monocot stem for skill development at global level.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	2	1	1	1	3
CO2	1	3	1	1	1	3	2	1	1	1	3	3
CO3	1	3	3	1	1	2	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1

Suggested Readings:

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

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

IFTM University, Moradabad

Bachelor of Science (Honours) Botany Programme

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

BBOCC (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 for skill development.

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, endoplsmic reticulum and ribosomes for skill development.

UNIT-II **(08 Sessions)**

Morphology and chemistry of chromosomes; Giant chromosomes-Polytene and Lampbrush Chromosomes. Euchromatin and heterochromatin for skill development.

UNIT-III **(06 Sessions)**

Cell cycle: mitosis; meiosis and their significance. Comparison of meiosis and mitosis for skill development.

UNIT-IV **(10 Sessions)**

Nucleic acids as genetic material (Avery et al. and Hershey and Chase experiments; FraenkelConrat'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 for skill development.

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 for skill development.

Course Outcomes:

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

CO1 Difference between prokaryotic eukaryotic cell and ultra structure of plant cell for enhancement of global knowledge.

CO2 Structure and functions of cell organelles for global skill development.

CO3 The eukaryotic cell cycle and mitotic and meiotic cell division for skill development.

CO4 Structure and chemistry of chromosomes, types of chromosomes for skill development.

CO5 Nucleic acid as genetic material, types of DNA, DNA replication and enzymes involved in DNA replication for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	3	1	1	2	1	3
CO2	1	3	1	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	2	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. Atherly, A.G. Girton, J.R. and McDonald, J.F. 1999. The Science of Genetics, Saunders College Publising , Fort Worth, USA.
2. Gupta, P.K. 1999. A text book of Cell and Molelcular Biology. Rastogi Publications,Meerut, India.
3. Kleinsmith, L. J and Kish, V.M. 1995. Principles of Cell and Molecular Biology (2nd
4. edition) Harper Collins College Publishers, New York, USA.
5. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimoe, D. and Darnell, J. 2000.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. P.S. Verma and V.K. Agarwal. Molecular Biology. S. Chand & Co., New Delhi.

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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. (Honours) Botany-II Year (IV Semester)

BBOCC (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 for skill development.

UNIT-I **(08 Sessions)**

Mendelism: Concept of dominance; genotype-phenotype concept, Mendel laws, incomplete dominance, test cross-back cross for skill development.
Interaction of genes: epistasis, supplementary and complementary
Linkage and Crossing over.
Cytoplasmic inheritance.

UNIT-II **(08 Sessions)**

Chromosomal abberations (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 for skill development.

UNIT-III **(08 Sessions)**

Aims and objectives of plant breeding; brief history of plant breeding.
Methods of plant breeding for skill development:

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

UNIT-IV **(08 Sessions)**

Hybrid vigour (Heterosis) and its application for skill development.
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 for skill development.

Course Outcomes:
On completion of the course, students will able to:

CO1 Explain the Mendelian inheritance, post mendelian inheritance and chromosomal aberration for enhancement of global knowledge.
CO2 Understand the science of plant breeding for skill development.
CO3 Study the techniques of production of new superior crop verities at national level for skill development.
CO4 Get the detail knowledge about modern strategies applied in Plant Breeding for crop improvement i.e. Mass selection, Pureline Selection and Clonal selection for skill development.
CO5 Know about exploitation of heterosis, hybrid and variety development and their release through artificial hybridization for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	2	1	2	3
CO2	1	3	1	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	1	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

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 Molelcular Biology (2nd edition). Harper Collins College Publishers, New York, USA.
4. Lodish, H., Berk, A., Zipursky, S.L., Matudaria, P., Baltimoe, 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 &ParulTyagi. Plant Breeding and Biotechnology. PragatiPrakashan . 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.pdf.com
- *en.wikipedia.org*
- 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. (Honours) Botany-II Year (IV Semester)

BBOCC (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 for skill development.

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:

CO1 Understand the various stages occurred in mitotic and meiotic cell divisions for enhancement of global knowledge.

CO2 Apply quantitative problem-solving skills to genetics problems and issues for skill development.

CO3 Select and apply experimental procedures to solve genetic problems at local level for skill development.

CO4 Perform the emasculation technique in various local crop plants for skill development.

CO5 Isolate and identify the plant DNA, chloroplast, mitochondria and nucleus for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	3	2	1	3	1	1	1	1	1	3
CO2	1	3	2	2	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	1	3	1	1	1	1	3	1	2	3	3
CO5	1	1	3	1	1	1	1	1	1	2	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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. (Honours) 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 for skill development.

UNIT-I **(08 Sessions)**

Water relation of plants: imbibitions, diffusion, osmosis, Plasmolysis, water potential, water absorption, loss of water and ascent of sap for skill development.

Mineral nutrition of plants: Physiological role and deficiency symptoms of micro and macronutrients to provide skills.

UNIT-II **(08 Sessions)**

Photosynthesis: structure of chloroplast, absorption of light, transfer of light energy, electron transport, photophosphorylation, C_3, C_4, CAM pathways of carbon fixation for skill development.

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 for skill development.

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) for skill development.

UNIT-V **(08 Sessions)**

Physiology of flowering: photoperiodism and vernalization.

Seed dormancy and germination for skill development.

Course Outcomes:

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

CO1 Understand the plants and plant cells in relation to water, the movement of sap and absorption of water in plant body for enhancement of global knowledge.

CO2 Know micro and macronutrients and their role in plant developments at national level for skill development.

CO3 Understand the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways for enhancement of global knowledge.

CO4 Understand the respiration in higher plants with particular emphasis on aerobic and anaerobic respiration for skill development.

CO5 Understand the plant movements, physiology of flowering, seed dormancy and germination for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	2	1	1	1	1	1	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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., Lefebre, 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 Physiolohy

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- 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. (Honours) 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 for skill development.

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 for skill development.

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 for skill development.

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 for skill development.

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 for skill development.

UNIT-V **(06 Sessions)**

Nitrogen metabolism: N_2 fixation (Symbiotic and Asymbiotic); assimilation into Amino-acids for skill development.

Course Outcomes:

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

CO1 Understand the structure of atoms, chemical bonding of molecules for enhancement of global knowledge.

CO2 Explain the structure and functions of biomolecules for enhancement of global knowledge.

CO3 Learn bioenergetics processes in plants for skill development.

CO4 Understand the principles of enzymes, enzyme kinetics, enzyme regulation and mechanism of enzyme action for skill development.

CO5 Students will also learn metabolism of biomolecules for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	1	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	2	2	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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.

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- *en.wikipedia.org*
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- www.freebookcentre.net

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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 for skill development.

UNIT-I **(06 Sessions)**
Defining plant stress: Acclimation and adaptation for skill development

UNIT-II **(08 Sessions)**
Environmentalfactors: Water stress; Salinity stress, High light stress; Temperature stress; Hypersensitive reaction; Pathogenesis– related (PR) proteins; Systemic acquired resistance; Mediation of insect and diseaseresistance byjasmonates for skill development.

UNIT-III **(06 Sessions)**
Stress sensing mechanisms in plants: Calciummodulation, Phospholipid signaling for skill development.

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 for skill development.

UNIT-V **(06 Sessions)**
Reactive oxygen species–Production and scavenging mechanisms for skill development

Course Outcomes:

CO1 On completing this course, the students will be able to understand for skill development
CO2 How does the stress the effect the physiology, morphology and anatomy of plants life for skill development?
CO3 Resistant mechanism in plants for enhancement of global knowledge.
CO4 The role of stressed hormones in plants for enhancement of global knowledge.
CO5 What is Reactive Oxygen Species (ROS) and what is the role of it in defense mechanism. For skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	3	1	3
CO2	1	3	1	1	1	3	1	1	1	3	3	3
CO3	1	3	3	1	1	1	2	1	1	2	1	3
CO4	1	1	3	1	1	1	2	3	1	1	3	3
CO5	1	1	3	1	1	1	1	2	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. Hopkins,W.G.andHuner,A.(2008).IntroductiontoPlantPhysiology. JohnWileyand 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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BBO (H)-504: ANALYTICAL TECHNIQUESINPLANTSCIENCES

Objective: The objective of this course is to provide knowledge on recent technological advances like molecular biology, biotechnology, plantphysiology and biochemistry to provide the entrepreneurship and skills.

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 to provide the entrepreneurship and skills.

UNIT-II **(08 Sessions)**

Cell fractionation: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, $CsCl_2$ gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Radioisotopes: Use in biological research, auto-radiography, pulse chase experiment to provide the entrepreneurship and skills.

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 to provide the entrepreneurship and skills.

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 to provide the entrepreneurship and skills.

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 to provide the entrepreneurship and skills.

Course Outcomes:

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

CO1 Learn the microscopy and its application; the different types of microscopes and what are uses of them in research for entrepreneurship and for enhancement of global knowledge?

CO2 Learn what are the radioisotopes? Why they are used in research for entrepreneurship and skill development?

CO3 Understand isolation techniques like Electrophoresis: AGE, PAGE, SDS-PAGE for analysis of DNA, RNA and proteins for entrepreneurship and for enhancement of global knowledge.

CO4 Learn data analysis by mean mode median, graphic representation of the data for entrepreneurship and skill development.

CO5 Know where mean deviation, variation, standard deviation; Chi-square test are used for entrepreneurship and for enhancement of global knowledge

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	2	1	2	3	3
CO2	1	3	2	1	1	3	1	2	1	2	3	3
CO3	1	3	3	1	1	2	1	1	1	2	1	3
CO4	1	1	3	1	1	2	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	2	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	2	3
CO2	3	2	3
CO3	3	2	3
CO4	3	2	3
CO5	3	2	3

Suggested Readings:

1. Plummer, D. T. (1996). AnIntroductiontoPracticalBiochemistry.Tata Mc Graw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). PlantMicrotechniqueand 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.
4. Zar, J.H. (2012). Biostatistical Analysis.Pearson Publication.U.S.A.4th edition.

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

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

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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 for skill development.

UNIT-I **(08 Sessions)**

Plantdiversityandits scope-Geneticdiversity,Speciesdiversity,Plantdiversityat theecosystemlevel,Agro-biodiversityand cultivatedplanttaxa,wildtaxa.Valuesandusesof Biodiversity:Ethical and aesthetic values, Precautionary principle, Methodologies for valuation,Usesofplants,Usesofmicrobes for skill development.

UNIT- I I **(08 Sessions)**

Loss ofBiodiversity: Lossofgeneticdiversity, Loss of species diversity, Loss of ecosystemdiversity, Loss of agro-biodiversity, projected scenario for biodiversity loss for skill development.

UNIT-III **(08Sessions)**

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

UNIT-IV **(08Sessions)**

ConservationofBiodiversity: Conservation of geneticdiversity, species diversity and ecosystemdiversity, *in-situ*and*ex-situ*conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development for skill development.

UNIT-V **(08Sessions)**

Role of plants in relation to Human Welfare; a)Importance offorestry 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:

CO1 Understand the concept and scope plant diversity for enhancement of global knowledge

CO2 Learn about the causes and implication of loss of biodiversity for skill development at global level.

CO3 Utilizes many strategies for the conservation of biodiversity for skill development and employability.

CO4 Understand the role of plants in human welfare for enhancement of global knowledge.

CO5 Understand the role of plants in human welfare for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	2	1	1	1	3	3
CO3	1	3	3	1	1	1	2	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	2	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	1	2	1
CO5	1	1	1

Suggested Readings:

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

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- 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 skills of nursery and gardening and learn how to seed is sowing, what are propagation methods? What is the use of computer in land scaping. It will also provide skill of employability and entrepreneurship.

UNIT-I **(08 Sessions)**

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

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 for Skill development.

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 glasshouse **.** It will also provide skill of employability and entrepreneurship.

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UNIT-IV **(08 Sessions)**

Gardening: definition, objectives and scope-different types of gardening-land scape and home gardening-parks and its components-plant materials and design-computer applications in land scaping-Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting It will also provide skill of employability and entrepreneurship.

UNIT-V **(08 Sessions)**

Sowing/raising of seeds and seedlings-Transplanting of seedlings-Studyof cultivation of different vegetables: cabbage, brinjal, lady'sfinger, onion, garlic, tomatoes, and carrots-Storage and marketing procedures to provide skill of employability and entrepreneurship.

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Course Outcomes:

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

CO1 Understand the process of sowing seeds in nursery for skill development.

CO2 Document the various resources required for the development of nursery at local level for entrepreneurship.

CO3 Distinguish among the different forms of sowing and growing plants for skill development.

CO4 Appreciate the diversity of plants and selection of gardening for skill development.

CO5 Examine the cultivation of different vegetables and growth of plants in nursery and gardening at local level for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	2	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	2
CO2	3	2	2
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

Suggested Readings:

1. BoseT.K. & Mukherjee,D.,1972,GardeninginIndia,Oxford & IBH Publishing Co., New Delhi.
2. Sandhu,M.K.,1989,Plant Propagation,WileEastern Ltd., Bangalore, Madras.
3. Kumar,N.,199, Introduction to Horticulture, Raja lakshmi 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 Cooperation,National SeedCorporationLtd.,NewDelhi.
6. Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco,USA.

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

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BBO (H) -507: FLORICULTURE

Objective: The main objective of this course to familiarize the students with biostatistics in plant science for developing **skills and entrepreneurship**.

UNIT-I **(08 Sessions)**

Definition, objectives, scope and building up of infrastructure for nursery. Planning and seasonal activities - Planting - direct seeding and transplants. Nursery Management and Routine Garden Operations for skill development.

UNIT-II **(10Sessions)**

Sowing/raising of seeds and seedlings, transplanting of seedlings. Airlayering, cutting, selection of cutting ,propagule collecting season, treatment of cutting rooting medium and planting of cuttings - Hardening of plants. Propagation of ornamental plants by rhizomes, corms tubers, bulbs and bulbils. Green house - mist chamber, shed root, shade house and glass house for propagation for skill development and employabilty.

UNIT-III **(10Sessions)**

Ornamental Plants: Flowering annuals; herbaceous, perennials; Divine vines; Shade and ornamental trees. Ornamental bulbous and foliage plants; Cacti and succulents. Ornamentals-palms for skill development.

UNIT-IV **(10Sessions)**

Cultivation of plants in pots; Indoor gardening; Bonsai.Cultivation of Important cut flowers (Carnation, Aster, Dahlia, Gerbera, Anthuriams, Gladiolous, Marigold, Rose, Lilium) for skill development.

UNIT-V (06Sessions)

Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life of flowers. Management of pests, diseases and harvesting. Methods of harvesting for skill development.

Course Outcomes:

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

CO1: Understand principles, methods of statistics and their uses for skill development.

CO2: Develop skills of tabulation and presentation of data as well as how to collect the data **to employaabilty**?

CO3: Have the knowledge of measures of central tendency like mean, mode and median for skill development.

CO4: Understand the types and methods of correlation and regression and their role in research for skill development.

CO5: know about student 't' test - chi square test for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	2	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	2	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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. institution)
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- www.freebookcentre.net

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BBO (H) -508: PHYTOPATHOLOGY

Objectives:

It is expected to provide general knowledge on plant-pathogen interaction and on basic principle of plant defense as well as practical skills and specific professional competences for skill development.

UNIT-I **(06Sessions)**

General disease cycle; economic impact of plant diseases; basic notions of epidemiology for skill development.

UNIT-II **(08Sessions)**

Measurement of microbial growth: Direct microscopic count, standard plate count, membrane filtration, MPN, Indirect method: turbidity, metabolic activity and dry weight. Automated microbial identification system for skill development.

UNIT- III **(08Sessions)**

The fungal infection process from spore germination to evasion from the host. Fungal pathogenicity: phytotoxins, lytic enzymes, hormons, Tools for the identification of other pathogenicity factors. Introduction to phytopathogenic bacteria and pathogenicity factors; Examples of bacterial pathogens: Erwinia amylovora; Agrobacterium tumefaciens; Pseudomonas syringae for skill development.

UNIT –IV **(08Sessions)**

Diagnosis of phytopathogenic fungi and bacteria plants; Introduction to phytopathogenic viruses. Taxonomy, morphology, replication cycle. Strategies of viral protein and viroids. Diagnosis of phytopathogenic viruses and viroids. Serological and molecular techniques for skill development.

UNIT- V **(08Sessions)**

Resistance of plants to pathogens - Pathogen perception; signals and molecules involved in plant resistance. Defense reactions; Systemic acquired resistance (SAR) and Induced systemic resistance (ISR). Basic principles in breeding for resistance for skill development.

Course Outcomes:

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

CO1: Have the knowledge of diseases, their causal organism, symptoms of the diseases, and their control measures for skill development.

CO2: The students will also learn how the pathogens affect the physiology of plants, host defense mechanism for skill development.

CO3: Know the effects of environment on disease development, host plant nutrition and disease forecasting for skill development.

CO4: Learn host – pathogen relationship and diseasemanagement for skill development.

CO5: The students will be taught about different methods of disease control for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	2	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

Suggested Readings:

1. Agrios, G. N. 1978: Plant Pathology.
2. Aneja, K. R. 1993: Experiments in Microbiology, plant pathology and Tissue culture.
3. Cooke, A. A. 1981: Diseases of Tropical and Subtropical field, Fiber and oil plants.
4. Gangopadhyay, S. 2004: Clinical Plant Pathology.
5. Kuijit, J. 1969: The Biology of parasitic flowering plants.
6. Mahadevan, A. and R. Shridhar, 1982. Methods in physiological plant pathology.
7. Mehrotra, R. S. 1980: Plant Pathology.Tata M Hill Pub.
8. Nyvall, R. F. 1970: Field Crop Diseases Handbook.
9. Paul Khurama, S. M. 1998: Pathological Problems of Economic crop plants and their management.
10. Planke, J. E. ander, 1968: Disease Resistance in plants.
11. Planke, J. E. Vander. 1963: Plant Diseases Epidemics and control.
12. Rangaswami, G. 1979: Diseases of crop plants in India.
13. Singh, R. S. 1998: Plant Diseases.

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

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BBO (H) -509: INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

Objective: This course aims *to transform* agriculture to build locally relevant food systems that strengthen the economic viability of rural areas without damaging the natural ecosystems.

Unit I **(05 Sessions)**

Scope of microbes in industry and environment for skill development.

Unit II **(12 Sessions)**

Microbial production of industrial products: Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, estimation (qualitative and quantitative) of Enzyme: amylase or lipase activity, Organic acid (citric acid or glutamic acid), alcohol (Ethanol) and antibiotic (Penicillin) for skill development.

Unit III **(12 Sessions)**

Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase) for skill development.

Unit IV **(06 Sessions)**

Microbes and quality of environment: Distribution of microbes in air; Isolation of microorganisms from soil, air and water skill development.

Unit V **(10 Sessions)**

Microbial flora of water: Water pollution, role of microbes in sewage and domestic waste water treatment systems. Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and fecal coliform in water samples for skill development.

Course Outcomes:

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

CO1: Understand about chemical processores, physical and edaphic factors affecting crops for skill development, employabilityand entrepreneurship development.

CO2: Gain the knowledge about the role of nitrogen in agroecosystem, weed ecology and weed management for skill development.

CO3: Learn about agricultural pests and their management for skill development

CO4: Understand about plant diseases and conservation genetic resourses to develop skills of employabilty

CO5: Understand about cropping systems and agroecosystems in the landscape for skill development

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	2	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	2	1
CO5	3	1	1

Suggested Readings:

1. Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010). Microbiology: An application based approach. Tata McGraw Hill Education Pvt. Ltd., Delhi.
2. Tortora, G.J., Funke, B.R., Case. C.L. (2007). Microbiology. Pearson Benjamin Cummings, San Francisco, U.S.A. 9th edition.

Website Sources:

- www.pdfdrive.com/botany-books.html
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- *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

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

BBO (H) -510: ADVANCED PLANT SYSTEMATICS

Objectives:

This course will provide an understanding of the biotic and abiotic causes of poor plats health together with knowledge of the practices and approaches use to diagnostics of plants health and wellbeing for developing skills of employability.

UNIT-I **(08 Sessions)**

Evidence from palynology, cytology, phytochemistry and molecular data. Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary).
Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybridsfor skill development

UNIT-II **(08 Sessions)**

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification.
Characters; Variations; OTUs, character weighting and coding; cluster analysis; Phenograms, cladograms (definitions and differences) for skill development.

UNIT- III **(08 Sessions)**

Plant disease Epidemiology, dissemination factors affecting the development of epidemics, Disease forecasting. Plant disease epidemic assessment. Transmission and Control of Plant Diseases for skill development and employability.

UNIT –IV **(08 Sessions)**

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades).origin& evolution of angiosperms; co-evolution of angiosperms and animals; methods of illustrating evolutionary relationship (phylogenetic tree, cladogram) for skill development and employability.

UNIT- V **(08 Sessions)**

Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):

Ranunculaceae , Brassicaceae, Myrtaceae , Umbelliferae , Asteraceae , Solanaceae , Lamiaceae - Salvia/Ocimum Euphorbiaceae , Liliaceae , Poaceae for skill development and employability.

Course Outcomes:

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

CO1: Understand the concepts and types of plant disease symptoms, causes and classification of diseases for skill development

CO2: Understand the evidences of modern taxonomy, and roll of ICBN in plant systematics skill development.

CO3: Learn about dissemination factors affecting the development of epidemics for skill development and employability.

CO4: Gain knowledge of terms and concept related to taxonomy for skill development and employability

CO5: Gain knowledge of vegetative and floral characters of plants for skill development and employability

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	2	3	1	1	1	1	3	1	1	3	3
CO5	1	2	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	2	2
CO4	3	2	2
CO5	3	2	2

Suggested Readings

1. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rdedition. 29
2. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
3. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.
4. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.
5. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.

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.

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

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 for skill development.

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

1. Plant Physiology for skill development:

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 for skill development:

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.

Course Outcomes:

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

CO1 Understand how water is absorbed by the plants through the osmosis and what is Plasmolysis and imbibitions for enhancement of global knowledge?

CO2 Find out the transpiration rate, respiration quotient of different respiratory substrates, photosynthesis rate under different conditions for skill development.

CO3 Know how do light and temperature effect the germination of seeds for skill development at global level?

CO4 Observe the carbohydrates, protein and lipids in plant products for enhancement of global knowledge.

CO5 Identify and explain the type of chlorophyll and amino acid present for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	2	1	1	2	3
CO4	1	1	3	1	1	1	1	3	1	1	1	3
CO5	1	1	3	1	1	1	1	2	1	1	1	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

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

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

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

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 for skill development.

List of Experiments: **(24 Sessions)**

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Toseparatenitrogenousbases by paper chromatography.
3. To separate sugars by thin layer chromatography.
4. Isolation ofchloroplastsby 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 thes eedlings in the absence and presence of salt stress.
9. Superoxide activity in seedlings in the absence and presence ofsalt stress.
10. Zymographic analysis of peroxidase.
11. Zymographic analysis of superoxide dismutase activity.
12. Quantitativeestimation and zymographic analysis ofcatalase.
13. Estimation of superoxide anions.

Course Outcomes:

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

CO1 Understand the blotting techniques, DNA fingerprinting and DNA sequencing for skill development at global level.

CO2 Estimate nitrogen bases, sugars by chromatography for skill development.

CO3 Isolate the chlorophyll pigments at local level for skill development.

CO4 Estimate the protein by Lowry's method for enhancement of global knowledge.

CO5 Analyze the different enzyme activity under stressed condition for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	2	1	1	1	3
CO2	1	3	1	1	1	3	1	2	1	1	3	3
CO3	1	3	3	1	1	2	1	3	1	1	1	3
CO4	1	1	3	1	1	2	1	3	1	1	3	3
CO5	1	1	3	1	1	2	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

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 Mannual 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*

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

IFTM University, Moradabad
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B. Sc. (Honours) Botany-III Year (VI Semester)

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 neutraceuticals for skill development.

UNIT-I **(08 Sessions)**

Introduction, Recombinant DNA technology: Restriction enzymes and cleavage; Agarose Gel Electrophoresis; Cloning vectors for skill development.

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 for skill development.

UNIT-III **(06 Sessions)**

Transfer of recombinant DNA into bacterial cell (host); downstream processing for skill development.

UNIT-IV **(08 Sessions)**

Application of Biotechnology in agriculture; Pest resistant crops Bt crops, RNAi mediated crops; functional food and neutralceuticals for skill development.

UNIT-V **(08 Sessions)**

Herbicide resistant transgenic plants; transgenic microbes; medical applications; production of enzymes, vitamins and antibiotics for skill development.

Course Outcomes:

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

CO1 Describe bio-catalysis, pathway engineering, bioprocess control and downstream processing for enhancement of global knowledge.

CO2 Demonstrate their ability to reason both inductively and deductively with experimental information and data for skill development.

CO3 Explain the theory and practice of recombinant DNA technology for enhancement of global knowledge.

CO4 Select and apply experimental procedures to the spectrum of fields making use of biotechnology for skill development.

CO5 Understand methods/procedures and different tools and techniques applied for proteome analysis for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	2	1	1	3
CO2	1	3	2	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	1	3	3
CO4	1	1	3	1	1	1	1	3	1	2	3	3
CO5	1	1	3	1	1	1	1	1	1	2	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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

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

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

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 for skill development.

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) for skill development.

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 for skill development.

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 for skill development.

UNIT-IV **(06 Sessions)**

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

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 for skill development.

Course Outcomes:

On completion this course, students will be able to:

CO1 Explain the ecological interconnectedness of life on earth by tracing energy and nutrient flow through the environment for skill development at global level.

CO2 Understand the effects of the physical features of the environment on the structure of populations, communities, and ecosystems for enhancement of global knowledge

CO3 Describe the plant succession and plant adaptations for skill development.

CO4 Understand the environmental pollution and its effects for skill development.

CO5 Develop the understanding of student about the successive development of plant community and structure and function of some Indian ecosystems for skill development at national level.

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PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	1	3
CO2	1	3	1	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

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.,
3. New Delhi.
4. Mackenzie, A. et al. 1999: Instant Notes in Ecology, Viva Books Pvt. Ltd., New
5. Delhi.
6. Joseph, B., Environmental studies, Tata Mc Graw Hill.
7. Chapman, J.L., Reiss, M.J. 1999. Ecology: Principles and applications (2nd edition) Cambridge University Press.
8. Sinha, S. 2010. Handbook on Wildlife Law Enforsement in India. TRAFFIC, India.
9. Singh, J.S., Singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi
10. Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth System Approach. Oxford.
11. Daubenmier, R.F. (1970). Plants and Environment: A text book of Plant Autoecology, Wiley Eastern Private Limited
12. 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,

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- www.yourarticlelibrary.com
- www.freebookcentre.net
- *onlineecourses.nptel.ac.in*

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

IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
B. Sc. (Honours) Botany-III Year (VI Semester)
BBO (H)-603: NATURALRESOURCES 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 for skill development.

UNIT-I **(08 Sessions)**

Natural resources: Definition and types.

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

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; Threatsandmanagementstrategies for skill development.

UNIT-III **(08 Sessions)**

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

UNIT-IV **(08 Sessions)**

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

Energy: Renewable and non-renewable sources of energy for skill development.

UNIT-V **(08 Sessions)**

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

National and international efforts in resource management andconservation for skill development and employbilty.

Course Outcomes:

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

CO1 Understand the concept of different natural resources and their utilization at local level for skill development

CO2 Critically analyze the sustainable utilization land, water, forest and energy resources at national level for skill development.

CO3 Evaluate the management strategies of different natural resources for skill development.

CO4 Renewable and non-renewable sources of energy at national level for skill development.

CO5 Reflect upon the different national and international efforts in resource management and their conservation for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	2	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	2	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. Vasudevan,N.(2006).EssentialsofEnvironmentalScience.NarosaPublishingHouse, New Delhi.
2. Singh,J.S.,Singh,S.P.andGupta,S.(2006).Ecology,EnvironmentandResource
3. Conservation. Anamaya Publications, New Delhi.
4. Rogers, P. P., Jalal, K. F. and Boyd, J. A. (2008). An introduction to Sustainable
5. 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

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

IFTM University, Moradabad
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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 (Descriptivevs analytical; applied vs fundamental; quantitative vs qualitative; conceptual vs emperical). Research methods vs methodology. Literature-review and its consolidation; Library research; field research; laboratory research for skill development.

UNIT-II **(08 Sessions)**

General laboratory practices: Common calculations in botanylaboratories. 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 for skill development.

UNIT-III **(08 Sessions)**

Data collection and documentation ofobservations: Maintaining a laboratory record; Tabulation and generation of graphs. Imaging of tissuespecimens and application of scale bars. The art of field photography for skill development.

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 for skill development.

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 ultra thin sections for skill development.

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

Course Outcomes:

CO1 Understand the concept of research and different types of research in the context of plant science for enhancement of global knowledge.

CO2 Enhance laboratory experiment related skills.

CO3 Develop competence on data collection and process of scientific documentation for skill development.

CO4 Analysis of ethical aspects of research for enhancement of global knowledge

CO5 Evaluate the different methods of scientific writing and reporting at global level for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	2	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	2	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. Dawson, C. (2002). Practicalresearchmethods. UBS Publishers, New Delhi.
2. Stapleton,P.,Yondeowei,A.,Mukanyange,J.,Houten,H.(1995).Scientificwritingfor agriculturalresearchscientists– atraining referencemanual.WestAfrica Rice Development Association, Hong Kong.
3. Ruzin,S.E.(1999).Plantmicrotechniqueandmicroscopy.OxfordUniversityPress,New York, U.S.A.

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- 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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IFTM University, Moradabad
Bachelor of Science (Honours) Botany Programme
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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 plantse to provid entrepreneurship and skill development.
- 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) Resins and oils and miscellaneous uses for skill development.

UNIT-II **(08 Sessions)**

Methodology of Ethnobotanical studies: a)Fieldwork b)Herbarium c)Ancient Literature d) Archaeological findings e) temples and sacredplaces for skill development.

UNIT-III **(08 Sessions)**

Role of Ethnobotany in modern Medicine: Medico-ethnobotanical sourcesin India; Significance of the following plants in ethnobotanical practices (alongwith their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superb* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria* for skill development and entrepreneurship.

UNIT-IV **(08 Sessions)**

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

UNIT-V **(08 Sessions)**

Ethnobotanyandlegalaspects: 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 for skill development.

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

CO1 Conceptualize Ethnobotany as an interdisciplinary science for skill development
CO2 Restate the established methodology of Ethnobotany studies at local level for skill development
CO3 Categories various indigenous ethnic groups and their environmental practices at national level for skill development.
CO4 Role of Ethnobotany in modern medicine for enhancement of global knowledge.
CO5 Understand the legalities associated with Ethnobotany for skill development

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	2	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	2	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3
CO5	3	1	3

Suggested Readings:

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) GlimpsesofIndian. Ethnobotny,Oxford and IBH, NewDelhi–1981
3. Loneetal,.Palaeo ethnobotany
4. S.K.Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists,
5. Lucknow, India.
6. S.K.Jain,(1990). Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
7. ColtonC.M.1997.Ethnobotany –Principles and applications. JohnWileyandsons–Chichester
8. Rama Ro, N and A.N. Henry (1996). The Ethnobotany of EasternGhats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
9. Rajiv K. Sinha–Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996
10. Faulks, P. J.(1958). An introduction to Ethnobotany, Moredale pub. Ltd.

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- *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)-606: ENVIRONMENTAL BIOTECHNOLOGY

Objective: The main objective of this course to familiarize the students with basic concepts and issues, global environmental problems for skill development.

UNIT-I **(08 Sessions)**

Environment - basic concepts and issues, global environmental problems – ozone depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, their impactand biotechnological approaches for management for skill development.

UNIT-II **(10 Sessions)**

An overview of atmosphere, hydrosphere, lithosphere and anthrosphere -environmental problems.Environmental pollution - types of pollution, sources of pollution, measurement of pollution, methods of measurement of pollution, fate of pollutants in the environment, Bioconcentration, bio/geo-magnification for skill development.

UNIT-III **(10 Sessions)**

Microbiology of waste water treatment, aerobic process - activated sludge, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic process - anaerobic digestion, anaerobic filters, up-flow anaerobic sludge blanket reactors. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industries for skill development.

UNIT-IV **(12 Sessions)**

Xenobiotic compounds - organic (chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants) and inorganic (metals, radionuclides, phosphates, nitrates). Bioremediation of xenobiotics in environment -ecological consideration, decay behavior and degradative plasmids, molecular techniques in bioremediation for skill development.

UNIT-V (10Sessions)

Role of immobilized cells/enzymes in treatment of toxic compounds. Biopesticides, bioreactors, bioleaching, biomining, biosensors, biotechniquesfor air pollution abatement and odour control Skil development for skill development.

Course Outcomes:
On completion of this course, the students will be able to:
CO1: understand the concept of metabolism, regulation and regulatory enzymes for skill development
CO2: gain knowledge about carbon assimilation in plants for skill development
CO3: Understand carbohydrate metabolism for skill development.
CO4: Learn about synthesis and breakdown of triglyceridesand mobilization of lipids in seed germination for skill development.
CO5: Understand the nitrogen metabolism for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	2	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	2	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	2	1	1	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. Waste water engineering - treatment, disposal and reuse, Metcalf and Eddy Inc., Tata McGraw Hill, New Delhi.
2. Environmental Chemistry, AK. De, Wiley Eastern Ltd, New Delhi.
3. Bioremidation, Baaker, KH and Herson D.S., 1994. Mc.GrawHillInc, NewYork.
4. Industrial and Environmental Biotechnology - Nuzhat Ahmed, Fouad M. Qureshi andObaid Y. Khan, _2006. Horizon Press.
5. Environmental Molecular Biology, Paul. A, Rochelle, 2001.Horizon Press.

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- www.pdfdrive.com/botany-books.html
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- *www.topfreebooks.org ›*
- www.pdf.com
- *en.wikipedia.org*
- www.yourarticlelibrary.com
- www.freebookcentre.net

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BBO-607: MUSHROOM CULTURE AND TECHNOLOGY

Objective: The main objective of this course to familiarize the students with biological instruments and their uses for skill development, employability and entrepreneurship.

UNIT-I **(10 Sessions)**

& history. Medicinal value of edible mushrooms;Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariellavolvacea, Pleurotuscitrinopileatus, Agaricusbisporus* for skill development, employability and entrepreneurship.

UNIT-II **(08 Sessions)**

Cultivation Technology: Infrastructure; substrates (locally available) Polythene bag,vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag for skill development.

UNIT-III **(08 Sessions)**

Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves for skill development, employability and entrepreneurship.

UNIT-IV **(12 Sessions)**

Factors affecting the mushroom bed preparation - Low cost technology, composting technology in mushroom production.Storage: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in saltsolutions for skill development, employability and entrepreneurship.

UNIT-V **(10 Sessions)**

Nutritional value of Mushrooms: Proteins - amino acids, mineral elements nutrition Carbohydrates, Crude fibre content - Vitamins. Food Preparation: Types of foods prepared from mushroom. Research Centres -National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value for skill development, employability and entrepreneurship.

Course Outcomes:

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

CO1: Understand the medicinal values of mushrooms, types of mushrooms available in India for skill development employability and entrepreneurship.

CO2: Understand about the techniques of mushroom cultivation for skill development.

CO3: Understand the culture preparation for skill development employability and entrepreneurship.

CO4: Understand the factors affecting the mushroom bed preparation for skill development employability and entrepreneurship.

CO5: Understand the details on nutritional value of Mushrooms for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	2	1	1	3
CO2	1	3	2	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	1	3	3
CO4	1	1	3	1	1	1	1	3	1	2	3	3
CO5	1	1	3	1	1	1	1	1	1	2	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	2
CO2	3	1	1
CO3	3	2	3
CO4	3	2	2
CO5	3	1	1

Suggested Readings:

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) OysterMushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

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

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

BBO (H)-608: WEED SCIENCE AND TECHNOLOGY

Objectives: This course aims to get introduced to students about weeds and weed management for skill development, employability.

UNIT-I **(08 Sessions)**

Biology of Weeds: Ecology of weeds, competition, reproduction of weeds. Seed biology for skill development.

UNIT-II **(10 Sessions)**

Weed Management Practices: Mechanical Practices, Cultural Practices, Biological control for skill development.

UNIT-III **(08 Sessions)**

Chemical Weed Control: Herbicide classification, Selectivity of herbicides, absorption and translocation of herbicides, Mode of action of herbicides, Detoxification mechanisms of herbicides.Weed resistance to herbicides for skill development, employability.

UNIT-IV **(08 Sessions)**

Weed Control Methods: Weed control in wheat, rice and vegetable crops. Control of five abnoxious weeds for skill development, employability.

UNIT-V **(10 Sessions)**

Shift of weed flora in cropping systems, Problematic weeds and their control, control of weed in non-cropped situations for skill development.

Course Outcomes:
Students, who successfully complete this course will be able to:
CO1: Understand biology and ecology of weeds for skill development.
CO2: Learn about biological control measurements for skill development.
CO3: Understand the chemical weed control methods for skill development employability.
CO4: Understand the weed control in wheat, rice and vegetable crops for skill development employability
CO5: Understand the cropping systems for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	2	1	1	3
CO2	1	3	2	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	1	3	3
CO4	1	1	3	1	1	1	1	3	1	2	3	3
CO5	1	1	3	1	1	1	1	1	1	2	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1
CO5	3	2	1

Suggested Readings:

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. _II Edition. Benjamin Cummings.

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- *www.topfreebooks.org ›*
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- www.freebookcentre.net

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IFTM University, Moradabad
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BBO (H)-609: ORGANIC FARMING & SUSTAINABLE AGRICULTURE

Objective: This course covers planning and production practices for market farms. Topics include seasonal crop selection, planting procedures, cultural practices, harvesting farm economy for organic production of vegetables and grain crops in small commercial operations for skill development, employability and entrepreneurship.

UNIT-I **(12 Sessions)**

Concept of organic farming: Introduction: Farming, organic farming, concept and development of organic farming.Principles of organic farming, types of organic farming, biodynamic farming. Benefits of organic farming, need for organic farming, conventional farming v/sorganic farming**.** Scope of organic farming; Requirements for organic farming, farm components for an organic farm for skill development.

UNIT-II **(12 Sessions)**

Organic plant nutrient management: Organic farming systems, soil tillage, land preparation and mulching. Choice of varieties. Propagation-seed, planting materials and seed treatments, water management, Green manuring, composting- principles, stages, types and factors, composting methods, Vermi composting; Bulky organic manures, concentrated organic manures, organic preparations, organic amendments and sludges; Bio-fertilizers- types, methods of application, advantages and disadvantages, standards for organic inputs-fertilizers for skill development, employability and entrepreneurship.

UNIT-III **(06 Sessions)**

Organic plant protection: Plant protection- cultural, mechanical, botanical pesticides, control agents; Weed management; Standards for organic inputs- plant protection for skill development.

UNIT-IV **(08 Sessions)**

Organic crop production practices: Organic crop production methods- rice, coconut; Organic crop production methods- vegetables- okra, amaranthus, cucurbits; Livestock component in organic farming; Sustainable Agriculture-Apiculture, Mushroom cultivation for skill development and entrepreneurship.

UNIT-V **(10 Sessions)**

Organic Certification: Farm economy: Basic concept of economics- demand &supply, economic viability of a farm; Basic production principles, reducing expenses, ways to increase returns, cost of production system. Benefit/ cost ratio, marketing, imports and exports; Policies and incentives of organic production; Farm inspection and certification for skill development.

Course Outcomes:

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

CO1: Understand the concept of organic farming for skill development.
CO2: Demonstrate organic farming systems, vermicomposting for skill development and employability.
CO3: Explain organic plant protection for skill development.
CO4: Gain knowledge about virus organic crop production for skill development and entrepreneurship.
CO5: Understand policies and incentives of organic production for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	2	1	1	3
CO2	1	3	2	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	1	3	3
CO4	1	1	3	1	1	1	1	3	1	2	3	3
CO5	1	1	3	1	1	1	1	1	1	2	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	2	1
CO3	3	1	1
CO4	3	2	1
CO5	3	2	1

Suggested Readings:

1. Palaniappan SP &Anandurai K. 1999.Organic Farming–Theory and Practice. Scientific Publishers, Jodhpur
2. Joshi, M. 2014. New Vistas of Organic Farming 2nd Ed. Scientific Publishers, Jodhpur.
3. Farming system: Theory and Practice - S.A.Solaimalai
4. Organic Farming: Theory and Practice- S.P.Palaniappan and K.A. Annadurai
5. A hand book of Organic Farming by A.K.Sharma

Website Sources:

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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 for skill development.

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

Biotechnology:

1. Plasmid DNA isolation: Mineprep
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 CO_3, NO_3, SO_4& Cl in soil.

Course Outcomes:

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

CO1 Isolate plasmid DNA for skill development

CO2 Know the practical aspects of Agrose gel electrophoresis for skill development

CO3 Find out Density, abundance, Frequency and Relative Frequency of plant species in given local area by quadrat method for skill development.

CO4 Know what effects of polluted water and saline water are on seed germination and seedling growth at local level for skill development.

CO5 Find out water holding capacity and qualitative presence of some mineral ions for skill development and entrepreneurship.

CO6 Identify the hydrophytes, xerophytes and halophytes on the basis of their morphological and anatomical features for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	1	1	2	3
CO2	1	3	1	1	1	3	1	1	1	1	3	3
CO3	1	3	3	1	1	1	1	1	1	1	2	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	1	1	3	3
CO6	1	3	1	1	1	1	1	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	2
CO6	3	1	1

Suggested Readings:

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:

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- 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

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BBO (H) -652: PROJECT/DISSERTATION&VIVA-VOCE

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

Contents: **(42 Sessions)**

Project / Dissertation will 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 for skill development.

Course Outcomes:

Students will acquire the following:

CO1 Training in experimental design and execution for skill development.

CO2 Knowledge on techniques and tools of research for enhancement of global knowledge.

CO3 Quantitative and qualitative data analysis for skill development.

CO4 Analysis and interpretation of data in the perspective of existing knowledge for enhancement of global knowledge.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	1	2	1	1	3
CO2	1	3	1	1	1	3	1	1	1	2	3	3
CO3	1	3	3	1	1	1	1	1	1	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1

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.

IFTM University, Moradabad
Bachelor of Science Programme

AECC* (AUDIT COURSE): ENVIRONMENTAL STUDIES

Objective: The aim of this course is to impart basic knowledge about the environment and its allied problems and also to develop an attitude of concern for the environment for skill development.

UNIT- I: **(5 Sessions)**

Introduction to environmental studies Multidisciplinary nature of environmental studies; components of environment – atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development for skill development.

UNIT –II: Ecosystems **(5 Sessions)**

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession for skill development. Case studies of the following ecosystems:
a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT -III: **(5 Sessions)**

Natural Resources: Renewable and Non-renewable Resources
Land conservation of Resources and land use change; Land degradation, soil erosion and desertification.
Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.
Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts over water (international & inter-state).
Heating of earth and circulation of air; air mass formation and precipitation.
Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies for skill development.

UNIT -IV: **(5 Sessions)**

Biodiversity and Conservation for skill development.
Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots
India as a mega-biodiversity nation; Endangered and endemic species of India
Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

UNIT- V: **(5 Sessions)**

Environmental Pollution
Environmental pollution: types, causes, effects and controls; Air, water, soil, chemical and noise pollution
Nuclear hazards and human health risks
Solid waste management: Control measures of urban and industrial waste. Pollution case studies for skill development.

UNIT VI: **(5 Sessions)**

Environmental Policies & Practices for skill development.
Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture.

Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC)
Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context

UNIT VII: **(5 Sessions)**

Human Communities and the Environment
Human population and growth rate: Impacts on environment, human health and welfares.
Carbon foot-print.Resettlement and rehabilitation of project affected persons; case studies.
Disaster management: floods, earthquakes, cyclones and landslides.
Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan.
Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.
Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi) for skill development.

UNIT-VIII: Field work **(5 Sessions)**

Visit to an area to document environmental assets; river/forest/flora/fauna, etc.
Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.
Study of common plants, insects, birds and basic principles of identification.
Study of simple ecosystems-pond, river, Delhi Ridge, etc for skill development.

Course Outcomes:

Students completing this course will be able to:

CO1 To learn about the components of environment: atmosphere, hydrosphere, lithosphere and biosphere for enhancement of global knowledge.

CO2 Study Natural Resources and types of resources, Renewable and Non-renewable Resources for enhancement of global knowledge.

CO3 Biodiversity patterns, Energy resources for skill development.

CO4 Environmental pollution: types, causes, effects and controls for skill development at national level.

CO5 Demonstrate a general understanding of the breadth and interdisciplinary nature of environmental issues for skill development.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	2	1	1	1	3
CO2	1	3	1	1	1	3	1	2	1	1	3	3
CO3	1	3	3	1	1	1	1	1	2	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3
CO5	1	1	3	1	1	1	1	1	2	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	**Employability**	**Entrepreneurship Development**
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	1	1

Suggested Readings:

1. Carson, R. 2002. Silent Spring.Houghton Mifflin Harcourt.
2. Gadgil, M., &Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis.Pacific Institute for Studies in Dev., Environment & Security.Stockholm Env.Institute, Oxford Univ. Press.
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6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
7. McCully, P.1996. Rivers no more: the environmental effects of dams(pp. 29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
9. Odum, E.P., Odum, h.T. & Andrews, J.1971. Fundamentals of Ecology. Philadelphia: Saunders.
10. Pepper, I.L., Gerba, C.P. &Brusseau, M.L. 2011. Environmental and Pollution Science.Academic Press.
11. Rao, M.N. &Datta, A.K. 1987. Waste Water Treatement.Oxford and IBH Publishing Co. Pvt. Ltd.
12. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment.8th edition.John Wiley & Sons.
13. Rosencranz, A., Divan, S., & Noble, M.L. 2001. Environmental law and policy in India.Tripathi 1992.
14. Sengupta, R. 2003.Ecology and economics: An approach to sustainable development. OUP.
15. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014. Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
16. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
17. Thapar, V. 1998. Land of the Tiger: A Natural History of the Indian Subcontinent.
18. Warren, C.E. 1971. Biology and Water Pollution Control. WB Saunders.
19. Wilson, E.O. 2006. The Creation: An appeal to save life on earth. New York: Norton.
20. World Commission on environment and Development. 1987. Our Common Future. Oxford University Press.

Website Sources

- https://aits-tpt.edu.in
- https://www.overpopulationawareness.org
- https://www.joboneforhumanity.org
- https://www.ugc.ac.in
- https://www.pmfias.com

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

IFTM University, Moradabad
Bachelor of Science Programme

UDM* (AUDIT COURSE): DISASTER MANAGEMENT

Objective: The goal of this course is to provide students an understanding to the concepts and aspects of disaster and its relationship with development and to give them awareness of Disaster Risk Reduction (DRR) approaches for skill development.

UNIT-I: (10 Sessions)

Introduction to Disasters for skill development.

- Definition: Disaster, Hazard, Vulnerability, Resilience, Risks
- Types of disasters – Earthquake, Landslide, Flood, Drought, Fire, campus shooting, bomb threat, terrorist incidence and financial emergency etc.
- Causes and Impacts including social, economic, political, environmental, health, psychosocial, etc. Differential impacts- in terms of caste, class, gender, age, location, disability.
- Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Do's and Dont's during various types of Disasters.

UNIT-II: (8 Sessions)

Approaches to Disaster Risk Reduction for skill development.

- Disaster life cycle – its analysis, phases, culture of safety, prevention, mitigation and preparedness
- Community based DRR (Disaster Risk Reduction), Structural-nonstructural measures,
- Roles and responsibilities of community: Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders

UNIT-III: (8 Sessions)

Inter-Relationship between Disasters and Development

- Factors affecting Vulnerabilities, impact of Development projects such as dams, embankments, changes in Land-use etc.
- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India – Relevance of indigenous knowledge, appropriate technology and local resources.
- Role of international co-operations in Disaster Management for skill development.

UNIT-IV: (8 Sessions)

Disaster Risk Management in India

- Hazard and Vulnerability profile of India. Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management
- Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy – Other related policies, plans, programmes and legislation
- Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment for skill development.

UNIT-V: (10 Sessions)

Disaster Management: Applications, Case Studies and Field Works for skill development.

The project /fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the institution is located. A few ideas or suggestions are discussed below.

Several governmental initiatives require Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to be pro active in preparing DM plans and community based disaster preparedness plans. Information on these would be available with the district collector or Municipal corporations.

Teachers could ask students to explore and map disaster prone areas, vulnerable sites, vulnerability of people (specific groups) and resources. The students along with teacher could work on ways of addressing these vulnerabilities, preparing plans and consultation with local administration or NGOs.
Students could conduct mock drills in schools, colleges or hospitals. They could also work on school safety, safety of college buildings, training in first aid.
Other examples could be- identifying how a large dam, road/ highway or an embankment or the location of an industry affects local environment and resources or how displacement of large sections of people creates severe vulnerabilities may be mapped by student project work.
The suggested topics for Project work for student could be as follows:

- Monitoring and evaluation plan for disaster response
- Low cost Home based water purification methods
- Planning Nutrition intervention programmes
- Safety tips before during and after earthquake, cyclone, floods and fire accidents.
- Mock Drills
- Major disasters in India
- Disaster Management in India
- Flood affected areas and damages in India
- Heat waves in India
- Earth quakes in India
- Historical Tsunamis in India
- Nuclear emergence
- Traffic accidents in India
- Train Accidents
- Major disease outbreak
- Disaster management structure in India
- Precaution, mitigation of disaster in India
- Warning system in India to prevent disaster
- Bhopal gas tragedy
- Kutch earth quake
- Tsunami (2004)
- Kosi Calamity 2008
- Mayapuri radiation exposure Delhi (2010)
- Mock exercises

Course Outcomes:
Students completing this course will be able to:

CO1 Disaster: types of Disasters, Causes Global trends in disasters for enhancement of global knowledge.

CO2 Disaster life cycle, Global trends in disasters for skill development.

CO3 Factors affecting Vulnerabilities, impact of Development projects for enhancement of global knowledge

CO4 Disaster Risk Management in India for skill development at national level.

PO-CO Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	1	1	3	1	2	1	1	1	3
CO2	1	3	1	1	1	3	1	2	1	1	3	3
CO3	1	3	3	1	1	1	1	1	2	1	1	3
CO4	1	1	3	1	1	1	1	3	1	1	3	3

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1

Suggested Readings:

1. Satish Modh, Introduction to Disaster Management, Macmillan Publisher India Ltd
2. Alexander David, Introduction in 'Confronting Catastrophe', Oxford University Press
3. Blaikie, P, Cannon T, Davis I, Wisner B 1997. At Risk Natural Hazards, Peoples' Vulnerability and Disasters, Routledge.
4. Damon P. Coppola, Introduction to International Disaster Management, Butterworth-Heinemann,
5. Singhal J.P. "Disaster Management", Laxmi Publications. ISBN-10: 9380386427 ISBN-13: 978-9380386423
6. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., ISBN-10: 1259007367, ISBN-13: 978-1259007361]
7. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi
8. KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi.
9. Carter, Nick. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila Philippines.
10. Cuny, F. Development and Disasters, Oxford University Press. Document on World Summit on Sustainable Development.
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12. Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi Indian Journal of Social Work.
13. Special Issue on Psychosocial Aspects of Disasters, Volume 63, Issue 2, April.

Websites Source:

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- http://nidmssp.in
- http://www.drishtiias.com

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