

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), Salem - 16

Reaccredited with 'B++' Grade by NAAC

(Affiliated to Periyar University)



B.Sc., Botany

OUTCOME BASED

DEPARTMENT OF BOTANY

(DBT STAR COLLEGE SCHEME Sponsored)

(For the students admitted from 2023 – 24 onwards)

Programme: B.Sc., Botany		
Programme Code: UBOT		
Duration: 3 years		
Programme Outcomes (PO)		
The B.Sc. Botany program is designed to achieve the following objectives		
PO1	Apply the knowledge of science and technology fundamentals for findings solution for complex problems.	
PO2	To provide up to date theoretical knowledge on various forms of plants, their interactions with biotic and abiotic entities in the ecosystem and relevant practical skills.	
PO3	To comprehend and interpret various facets of Botany including the importance and judicious utilization of plant sources.	
PO4	Exploration of diverse plant life-forms and to nature the conservation of biodiversity.	
PO5	To understand the principles and applications of various traditional and modern techniques used in Botany.	
PO6	To disseminate knowledge on the design and execution of experiments in Botany with emphasis on the operation of relevant sophisticated instruments.	
PO7	To impart knowledge on the economic importance of plant/microbial resources and their products and to promote entrepreneurship skill.	
PO8	To promote proficiency in designing the research problems, review of literature, laboratory experiments, data analyses and preparation of reports with professional ethics.	
PO9	To motivate the students to take up innovative and cutting-edge research in frontier areas of Botany and related biology subjects.	
PO10	To enable the students to take up various qualifying examinations concerning Botany and to face the challenges in career opportunities.	
Program specific Outcomes (PSO)		
On successful completion of the B.Sc. Botany program, the students are expected to		
PSO1	Implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology.	
PSO2	Ensure the use of contemporary tools and techniques in understanding the scope and significance of Botany	
PSO3	Develop the scientific problem solving skills during experimentation, research projects, analysis and interpretation of data	
PSO4	Design scientific experiments independently and to generate useful information to address various issues in Botany.	
PSO5	Enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings	
PSO6	Design and standardize protocols for public health and safety, and cultural, societal, and environmental considerations	
PSO7	Apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.	
PSO8	Demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.	
PSO9	Follow the concept of professional ethics and bioethics norms for practicing the value of plant kingdom.	
PSO10	Communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively	
Methods of Evaluation Theory		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	

	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
	Methods of Evaluation Practicals	
	Continuous Internal Assessment Test	40 Marks
	Attendance and Class Participation	
External Evaluation	End Semester Examination	60 Marks
	Record	
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

In order to avoid pull the score down of each PO, it is suggested that the usage L-Low (1) to the minimum.

The S, M, L is based on the Course outcomes. The mapping is based on the revised Bloom's Taxonomy Verbs used to describe your Course outcomes.

- Remember and Understanding – Lower level
- Apply and Analyze – Medium Level
- Evaluate and Create – Strong Level

SRI SARADA COLLEGE FOR WOMEN (AUTONOMOUS), SALEM-16

DEPARTMENT OF BOTANY (DBT Star College Scheme Sponsored)

B.Sc., BOTANY

PROGRAMME STRUCTURE UNDER CBCS

(For the students admitted in 2023–24 Onwards)

Total Credits: 140 + Extra Credit (Maximum 28)

SEMESTER I					
Part	Course	Course Title	Code	Hrs./ week Lecture/ Tutorial	Credits
I	Language	Tamil-I/ Hindi-I/ Sanskrit – I	23ULTC1/ 23ULHC1/ 23ULSC1	6	3
II	English	General English – I	23ULEC1	6	3
III	Core Course – I	Plant Diversity I – Algae	23UBOCC1	5	5
	Core Course – II	Core Practical I- Plant Diversity I – Algae	23UBOCCQ1	4	3
	Generic Elective I	Zoology– I	23UBOGEC1	3	3
		Zoology Practical - I	23UBOGECQ1	2	2
IV	Skill Enhancement Course (NME – I)	Nursery and Landscaping/ Organic Farming	23UBOSEC1	2	2
	Skill Enhancement (Foundation Course)	Basics of Botany	23UBOSEFC	2	2
	TOTAL			30	23
	<ul style="list-style-type: none">• Articulation and Idea Fixation skills• Physical Fitness Practice – 35 hrs. per semester• Advanced Diploma in Gardening and Landscaping Level 1: Certificate course in Gardening - 100 Hrs. per year				

SEMESTER II

Part	Course	Course Title	Code	Hrs./week Lecture/ Tutorial	Credits
I	Language	Tamil/ Hindi/ Sanskrit – II	23ULTC2/ 23ULHC2/ 23ULSC2	6	3
II	English	General English – II	23ULEC2	6	3
III	Core – III	Plant Diversity II – Fungi, Bacteria, Viruses, Plant pathology and Lichens	23UBOCC2	5	5
	Core – IV	Plant Diversity II – Fungi, Bacteria, Viruses, Plant pathology and Lichens - Practical – II	23UBOCCQ2	4	3
	Generic Elective II	Zoology – II	23UBOGEC2	3	3
		Zoology Practical – II	23UBOGECQ2	2	2
IV	Skill Enhancement Course - SEC-II (IKS)	Traditional System of Plant Therapy / Herbal Medicine	23UBOSEC2	2	2
	Skill Enhancement Courses SEC3	Mushroom Cultivation	23UBOSEC3	2	2
	TOTAL			30	23
	<ul style="list-style-type: none"> • Articulation and Idea Fixation skills • Physical Fitness Practice – 35 hrs. per semester • Advanced Diploma in Gardening and Landscaping Level 1: Certificate course in Gardening - 100 Hrs. per year				

SEMESTER III					
Part	Course	Course Title	Code	Hrs/ week	Credits
I	Language	Tamil III Hindi III Sanskrit III	23ULTC3 23ULHC3 23ULSC3	6	3
II	English	English III	23ULEC3	6	3
III	Core – V	Plant Diversity – III – Bryophytes and Pteridophytes	23UBOCC3	5	5
	Core - Practical	Core Practical – III Plant Diversity – III – Bryophytes and Pteridophytes	23UBOCCQ3	4	-
	Generic Elective – III	Chemistry – I	23UBOGE3	3	3
	Generic Elective Practical III	Chemistry Practical I	23UBOGEQ3	2	2
	Skill Enhancement Courses SEC IV	Entrepreneurial opportunities in Botany (Entrepreneurial Skill)	23UBOSEC4	1	1
	Skill Enhancement Courses SEC V	Herbal Technology	23UBOSEC5	2	2
IV	IV	Environment Studies	23UEVSC	1	-
	TOTAL			30	19
	Remark: Soft Skill III (2 hours handled by English; Totally 4+2= 6)				
V	Society Connect Activity	Group Project based on Society Connect Activity			
VI	Articulation and Idea Fixation skills- 6 Hrs. per semester (out of college hours – 1 credit extra) Life Skills Promotion – 2 Hrs per semester (out of college hours – 1 credit extra) Physical Fitness Practice – 35 Hrs per semester (out of college hours – 1 credit extra)				

SEMESTER IV					
Part	Course	Course Title	Code	Hrs/ week	Credits
I	Language	Tamil IV Hindi IV Sanskrit IV	23ULTC4 23ULHC4 23ULSC4	6	3
II	English	English IV	23ULEC4	6	3
III	Core – VI	Plant Diversity – IV – Gymnosperms, Paleobotany and Evolution	23UBOCC4	6	5
	Core - VII	Core Practical – III Plant Diversity IV, Gymnosperms, Paleobotany and Evolution - Practical-III	23UBOCCQ3	2	3
	Generic Elective – III	Chemistry – I	23UBOGECC4	3	3
	Generic Elective Practical III	Chemistry Practical I	23UBOGECCQ4	2	2
	Skill Enhancement Courses SEC VI	Fermentation Technology	23UBOSEC6	2	2
	Skill Enhancement Courses SEC VII	Environmental Impact Analysis	23UBOSEC7	2	2
IV	IV	Environment Studies	23UEVSC	1	2
		TOTAL		30	25
	Remark: Soft Skill III (2 hours handled by English; Totally 4+2= 6)				
V	Society Connect Activity	Group Project based on Society Connect Activity			
VI	Articulation and Idea Fixation skills- 6 Hrs. per semester (out of college hours – 1 credit extra) Life Skills Promotion – 2 Hrs per semester (out of college hours – 1 credit extra) Physical Fitness Practice – 35 Hrs per semester (out of college hours – 1 credit extra)				
	Second Year Vacation- Internship- 40 hours			2 credits	

Programme Title : B. Sc. Botany

Course Title : Plant Diversity- I Algae

Course Code : 23UBOCC1

Hours/Week : 5

Semester : I

Credits: 5

Course Objectives: The course aims

- To provide a comprehensive knowledge on the biology of algae.
- To provide a basis for better understanding of the evolution higher of plants.
- To understand reproductive biology, ecology of plants by studying the simpler systems in algae.
- To understand the role of algae in ecosystems as primary producers of nutrition.
- To understand importance of algae to animals and humans.

Syllabus

Unit I - (Hours:15)

Classification (Fritsch-1935-1945), criteria for classification, algal distribution.

Unit II - (Hours:15)

Thallus organization (unicellular-*Chlorella*, Diatoms, colonial-*Volvox*, filamentous-*Anabaena*, *Oedogonium*, siphonous - *Caulerpa*, parenchymatous - *Sargassum*, *Gracilaria*).

Unit III - (Hours:15)

Reproduction-Vegetative, asexual, sexual reproduction and life histories (haplontic-, *Oedogonium* and *Chara*, diplontic-Diatoms and *Sargassum*, diplohaplontic-*Ulva* and diplobiontic-*Gracilaria*) (Examples may be changed according to the availability of the specimens).

Unit IV - (Hours:15)

Algal cultivation methods, Algal production systems; indoor cultivation methods and large-scale cultivation of algae, harvesting of algae.

Unit V - (Hours:15)

Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite. Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical. Phycoremediation. Role of algae in CO₂ sequestration, Algae as indicator of water pollution, algal bioinoculants, Bioluminescence.

Books for Study:

- 1 Dehradun. Edwardlee, R. 2018. Phycology, 5th Ed., Cambridge University Press, London.

- 2 Kumar, H.D. 1999. Introductory Phycology. Affiliated East-West Press, Delhi
- 3 Singh, Pandey and Jain. 2020. A text book of Botany, 5th Edition, Rastogi Publication, Meerut.
- 4 Vashishta, P.C. 2014. S.Chand & Company Ltd, New Delhi.
- 5 Ian Morris. 1977. An introduction to the algae. Hutchinson & Co (Publishers) Ltd. London.

Books for Reference:

- 1 Aziz, F and Rasheed, R. 2019. A Course Book of Algae. Publisher: University of Sulaimani. ISBN: 978-9922-20-391-1.
- 2 Mihir Kumar, D. 2010. Algal Biotechnology. Daya Publishing House, New Delhi.
- 3 Chapman V.J. and Chapman D.J, 2013. The Algae. Alpha Numera.
- 4 Fritsch, F.E. 1945. Structure and reproduction of Algae. Cambridge University press.
- 5 Round, FE. 1984. The Ecology of Algae. Cambridge University Press.
- 6 Lee, R.D. 2008. Phycology 4th Edition, Cambridge University Press, New York.
- 7 Bold, H.C and Wynne, M.J. 1978. Introduction to the Algae: Structure and Function. Prantice Hall of India New Delhi.

Web Resources:

- 1 <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
- 2 <https://www.crcpress.com/Therapeutic-and-Nutritional-Uses-of-Algae/Pereira/p/book/9781498755382>
- 3 <https://www.crcpress.com/Algae-Anatomy-Biochemistry-and-Biotechnology-Second-Edition/Barsanti-Gualtieri/p/book/9781439867327>
- 4 <https://www.crcpress.com/Marine-Algae-Biodiversity-Taxonomy-Environmental-Assessment-and-Biotechnology/Pereira-Neto/p/book/9781466581678>
- 5 <https://www.kopykitab.com/Botany-For-Degree-Students-ALGAE-by-B-R-Vashishta-Dr-A-K-Sinha-Dr-V-P-Singh>
- 6 <https://www.wileyindia.com/a-textbook-of-algae.html>
- 7 <https://www.kobo.com/in/en/ebook/algae-biotechnology>
- 8 <https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-algae/9788188237449/>

Course outcomes	On completion of this course, students will;	
CO1	Relate to the structural organization, reproduction and significance of algae.	K1
CO2	Demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth	K2
CO3	Explain the benefits of various algal technologies on the ecosystem.	K3
CO4	Compare and contrast the thallus organization and modes of reproduction in algae.	K4
CO5	Determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.	K5

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	1	3	2	1	2	2	2	1
CO 2	3	3	2	2	3	3	2	1	3	3
CO 3	2	2	1	1	2	2	1	3	2	2
CO 4	3	3	3	3	3	2	3	3	3	2
CO 5	3	3	2	3	2	3	3	3	2	3

S - Strong (3) M - Medium (2) L - Low(1)

Programme Title	: B. Sc. Botany	
Course Title	: Core Practical I - Plant Diversity – I Algae	
Course Code	: 23UBOCCQ1	Hours/Week : 4
Semester	: I	Credits: 3

Syllabus

1. Micro-preparation of the types prescribed in the syllabus.
2. Identifying the micro slides relevant to the syllabus.
3. Identifying types of algal mixture.
4. Economic importance of Algae as: (i) Food (ii) Feed (iii) Biofertilizers (iv) Seaweed liquid fertilizer (v) Hydrogen production by algae (vi) SCP (vii) Agar Agar (viii) Alginate (ix) Diatomaceous earth.
5. Field visit to study fresh water/marine water algal habitats. Visit to nearby industry actively engaged in algal technology.

Programme Title	: B. Sc. Botany	
Course Title	: Generic Elective – Zoology I	
Course Code	: 23UBOGE1	Hours/Week : 3
Semester	: I	Credits: 3

Course Objectives: The course aims

- To acquire a basic knowledge of diversity and organization of Protozoa, Coelenterata, Helminthes and Annelida.
- To acquire a basic knowledge of diversity and organization of Arthropoda, Mollusca and Echinodermata.
- To comprehend the taxonomic position and diversity among Protochordata, Pisces and Amphibia.
- To comprehend the taxonomic position and diversity among Reptilia, Aves and Mammalia.
- To acquire detailed knowledge of select invertebrate and chordate forms.

Syllabus

Unit I (Hours : 12)

Diversity of Invertebrates–I: Principles of taxonomy. Criteria for classification – Symmetry and Coelom – Binomial nomenclature. Classification of Protozoa, Coelenterata, Helminthes and Annelida upto classes with two examples.

Unit II (Hours : 12)

Diversity of Invertebrates–II: Classification of Arthropoda, Mollusca and Echinodermata upto class level with examples.

Unit I (Hours : 12)

Diversity of Chordates–I: Classification of Prochordata, Pisces and Amphibia upto orders giving two examples.

Unit I (Hours : 12)

Diversity of Chordates–II: Classification of Reptilia, Aves and Mammalia upto orders giving two examples.

Unit I (Hours : 12)

Animal organization: Structure and organization of (i) Earthworm (ii) Rabbit/Rat (iii) Prawn/Fish.

Books for study:

1. Ekambaranatha Iyer,- Outlines of Zoology Viswanathan Publication

Book for Reference:

1. Ekambaranatha Iyar and T.N.Ananthakrishnian - A Manual of Zoology Invertebrata – Vol I: Viswanathan Publishers.
2. Ekambaranatha Iyar and T.N.Ananthakrishnan,- A Manual of Zoology - Invertebrata – Vol II: Viswanathan Publishers.
3. Ekambaranatha Iyar and T.N.Ananthakrishnan,- A Manual of Zoology: Chordata Viswanathan Publishers.
4. Jordan E.L. and P.S. Verma-Invertebrate Zoology, S. Chand&Co.

Web resources:

1. www.sanctuaryasia.com
2. www.iaszoology.com

Course Outcomes	On completion of this course, students will;	
CO1	Recall the characteristic features invertebrates and chordates.	PO1
CO2	Classify invertebrates up to class level and chordates up to order level	PO1, PO2
CO3	Explain and discuss the structural and functional organisation of some invertebrates and chordates	PO4, PO6
CO4	Relate the adaptations and habits of animals to their Habitat	PO4, PO5, PO6
CO5	Analyse the taxonomic position of animals.	PO3, PO8

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S							
CO 2	M	S						
CO 3				S		S		
CO 4				S	S	M		
CO 5			S					S

S - Strong (3)**M - Medium (2)****L - Low (1)**

Programme Title	: B. Sc. Botany	
Course Title	: Generic Elective – Zoology Practical I	
Course Code	: 23UBOGEQ1	Hours/Week : 2
Semester	: I	Credits: 2

Syllabus

MAJOR PRACTICAL

- Earthworm- Nervous system
- Cockroach –Digestive and Nervous System
- Prawn – Nervous system
- Fish-Digestive and Nervous system(Demo)

MINOR PRACTICAL

- Earthworm- Body Setae
- Mouth parts of Honey Bee.
- Mouth parts of House fly.
- Mouth parts of Cockroach

SPOTTERS

Identification and Description of :

- Paramecium,
- Paramecium Conjugation,
- Obelia Colony,
- Obelia Medusa
- Liverfluke,
- Tape worm,
- Ascaris male and female
- Pila-Radula and Jaws
- Starfish-oral and aboral view
- Amphioxus
- Shark-Entire
- Scales of fishes
- Frog Egg
- Frog – Blastula
- Frog – Gastrula
- Pigeon-Quill feather

Programme Title : B.A./ B. Sc./ B. Com.

Course Title : Non-Major Elective I : Nursery and Landscaping

Course Code : 23UBOSEC1

Hours/Week : 2

Semester : I

Credits: 2

Course Objectives: The course aims

- To recognize the importance of growing plants and practice the knowledge gained by developing kitchen garden and ornamental garden.
- To be able to design gardens and become entrepreneur in Horticulture.
- To study the methods of propagation.
- To know about nursery structure.
- To learn about gardening.

Syllabus

Unit I

Introduction, prospects and scope of nursery and landscaping.

Unit II

Methods of Propagation – cutting, layering, grafting, budding, Floriculture – Rose, Chrysanthemum, Jasmine – cultivation.

Unit III

Gardening – formal garden, informal garden, vegetable garden, landscaped layout designing – formation and maintenance of lawn.

Unit IV

Nursery structures – Green house – Shade house, Mist chamber – Topiary, Bonsai Culture.

Unit V

Planning residential and non-residential landscape: Site analysis, Assessment of the area, Designing. Examples – House, College.

Books for study:

1. Amarnath V. 2006. Nursery and Landscaping, M/s IBD Publishers, New Delhi.
2. Butts, E and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands(Nature Guides). Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
4. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.

- Butts, E. and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd.

Books for Reference:

- Edmond Musser and Andres, Fundamentals of Horticulture, McGraw Hill Book Co. New Delhi.
- Agrawal, P.K. 1993. Hand Book of Seed Technology, Dept. of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi.
- Janick Jules. 1979. Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco, USA.
- Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers.
- Sharma V. K. 1999. Encyclopaedia of Practical Horticulture, Vol I–IV, Deep And Deep Publ. Pvt. Ltd.

Web Resources

- <https://www.kopykitab.com/higher-education-ebooks/higher-education-ebooks/Agricultural-Industry-agriculture-eBooks/Nursery-And-Landscaping-by-V-Amarnath>
- <https://www.amazon.in/Nursery-Landscaping-Veena-Amarnath/dp/8177542788>
- <https://www.amazon.in/Gardening/b?ie=UTF8&node=1637077031>
- <https://in.pinterest.com/pin/496733033900458021/?lp=true>
- <https://www.gardenvisit.com/ebooks>

Course outcomes	On completion of this course, students will;	
CO1	Recognize the basic principles and components of gardening.	K1
CO2	Explain about bio- aesthetic planning and conceptualize flower arrangement.	K2
CO3	Apply techniques for design various types of gardens according to the culture and art of bonsai.	K3 & K6
CO4	Compare and contrast different garden styles and landscaping patterns.	K4
CO5	Establish and maintain special types of gardens for outdoor and indoor landscaping.	K5 & K6

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	3
CO 2	3	3	2	2	3	3	2	2	2	2
CO 3	2	2	3	1	1	1	1	3	3	1
CO 4	3	2	2	1	3	2	1	3	2	1
CO 5	3	3	2	3	2	1	2	3	2	3

S-Strong (3)

M-Medium (2)

L-Low (1)

Programme Title : B. Sc. Botany

Course Title : Foundation Course : Basics of Botany

Course Code : 23UBOSEFC

Hours/Week : 2

Semester : I

Credits: 2

Course Objectives: The course aims

- To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.
- To understand the biodiversity by describing and explaining the morphology and reproductive processes of algae, fungi, bryophytes and microorganisms.
- To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
- Enable to learn various cell structures and functions of prokaryotes and eukaryotes and understand the salient features and functions of cellular organelles.
- Understanding of laws of inheritance, genetic basis of loci and alleles.

Syllabus

Unit I

BIODIVERSITY

Systematics : Two Kingdom and Five Kingdom systems - Salient features of various Plant Groups : Algae, Fungi, Bryophytes, Pteridophytes and Gymnosperms- Viruses - Bacteria.

Unit II

CELL BIOLOGY

Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) - Light Microscope and Electron Microscope Ultra Structure of Prokaryotic and Eukaryotic Cells - Cell Wall - Cell Membrane Plastids, Ribosomes.

Unit III

PLANT MORPHOLOGY

Structure and Modification of Root, Stem and Leaf - Structure and Types of Inflorescences - Structure and Types of Flowers, Fruits and Seeds.

Unit IV

GENETICS

Concept of Heredity and Variation - Mendel's Laws of Inheritance.

Unit V

PLANT PHYSIOLOGY

Cell as a Physiological Unit : Water relations -Absorption and movement : Diffusion, Osmosis, Plasmolysis, Imbibition -Permeability, Water Potential - Transpiration - Movement - Mineral Nutrition

Books for study:

1. Singh, V., Pande, P.C and Jain, D.K. 2021. A Text Book of Botany. Rastogi Publications, Meerut.
2. Bhatnagar, S.P and Alok Moitra. 2020. Gymnosperms, New Age International (P) Ltd., Publishers, Bengaluru.
3. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
4. Lee, R.E. 2008. Phycology, IV Edition, Cambridge University Press, New Delhi.
5. Pandey B.P. 1986, Text Book of Botany (College Botany) Vol I and II, S. Chand and Co. New Delhi.
6. Rao, K., Krishnamurthy, K.V and Rao, G.S. 1979. Ancillary Botany, S. Viswanathan Pvt. Ltd., Madras.

Books for Reference:

1. Parihar, N.S. 2012. An introduction to Embryophyta –Pteridophytes - Surjeet Publications, Delhi.
2. Alexopoulos, C.J. 2013. Introduction to Mycology. Willey Eastern Pvt. Ltd.
3. Vashishta, P.C. 2014. Botany for Degree Students Gymnosperms. Chand & Company Ltd, Delhi.
4. Coulter, M. Jhon, 2014. Morphology of Gymnosperms. Surjeet Publications, Delhi.
5. Vashishta, P.C. 2014. Botany for Degree Students Algae. 2014. Chand & Company Ltd, Delhi.
6. Parihar, N.S. 2013. An introduction to Embryophyta –Bryophytes -, Surjeet Publications, Delhi.

Web Resources

1. <https://www.kobo.com/us/en/ebook/the-algae-world>
2. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. <https://www.toppr.com/guides/biology/plant-kingdom/pteridophytes/>

5. <https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf>
6. <https://www.us.elsevierhealth.com/medicine/cell-biology>
7. <https://www.us.elsevierhealth.com/medicine/genetics>
8. <https://www.kobo.com/us/en/ebook/plant-biotechnology-1>

Course outcomes	On completion of this course, students will;	
CO1	Increase the awareness and appreciation of human friendly algae and their economic importance.	K1
CO2	Develop an understanding of microbes and fungi and appreciate their adaptive strategies	K2
CO3	Develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	K3
CO4	Compare the structure and function of cells and explain the development of cells.	K4
CO5	Understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	K5

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	3	3	3	3	3	3
CO 3	2	3	3	3	3	1	3	3	1	3
CO 4	3	3	2	3	3	3	3	2	3	3
CO 5	3	2	2	2	2	2	2	1	2	2

S-Strong (3) M-Medium (2) L-Low (1)

Programme Title : B. Sc. Botany

Course Title : Plant Diversity II - Fungi, Bacteria, Viruses, Plant Pathology and Lichens

Course Code : 23UBOCC2

Hours/Week : 5

Semester : II

Credits: 5

Course Objectives: The course aims

- To describe the common characteristics of fungi as being heterotrophic, unicellular/multicellular.
- To understand the biology of fungi and to discuss the importance of fungi in various ecological roles.
- To understand lichen structure, function, identification, and ecology; Comprehend the events of symbiosis and lichenization and to demonstrate the use of lichens as bioindicator species.
- To identify the main groups of plant pathogens, their symptoms.
- To understand the various types of plant diseases.

Syllabus

Unit I (Hours: 15)

Classification of fungi - (Alexopoulos and Mims, 1979), criteria for classification, Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of classes, each with one suitable example: Zygomycotina (*Rhizopus*), Ascomycotina (*Peziza*), Basidiomycotina (*Puccinia*) and Deuteromycotina (*Cercospora*).

Unit II (Hours: 15)

Cultivation of mushroom – *Pleurotus* (food). Fungi in agriculture application (biofertilizers including VAM): Mycotoxins (biopesticides), Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B-complex and Vitamin B-12), Applications of fungi in pharmaceutical products (Penicillin). Harmful effects of Fungi: Mycotoxins.

Unit III (Hours: 15)

BACTERIA, VIRUS: General characters of Bacteria. Morphology and ultra structure of bacteria. Mode of Nutrition in Bacteria: Heterotrophic-parasitic, saprophytic, symbiotic; autotrophic-chemosynthetic, Photosynthetic. Reproduction in bacteria. Classification

(Bergey's, 1994). Economic importance of bacteria: Agriculture, Industry-butter, cheese, vinegar, alcohol, tobacco and tea curing, tanning, retting; sewage, medicines etc. Mycoplasma: History, general characters and cell structure of Mycoplasma Virology - Viruses general characters, structure and reproduction of plant viruses. Structure of reproduction of Bacteriophage.

Unit IV (Hours: 15)

PLANT PATHOLOGY: General symptoms of plant diseases; Geographical distribution of diseases; Etiology; Host-Pathogen relationships; Disease cycle and environmental relation; Prevention and control of the following plant diseases. **Bacterial diseases** – Citrus canker and Bacterial blight of paddy **Viral diseases** – Tobacco Mosaic and Vein clearing of Papaya **Fungal diseases** – Blast disease in rice and Tikka disease of groundnut.

Unit V (Hours: 15)

LICHEN: Classification (Hale, 1969). Habitat, nature of association, Structure, Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose), types, distribution, thallus organization, reproduction and ecological significance of lichens with special reference to *Usnea*.

Economic importance of Lichens: food, fodder and nutrition, flavor, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals, Natural products, medicine (Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation, nitrogen fixation, Harmful aspects, poison from lichens.

Books for study:

1. Pandey, B.P. 1997. College Botany. Vol. I Fungi & Pathology.
2. Mehrotra, R.S and Aneja, K.R. 2003. An introduction to mycology. New age International (P) Ltd, Publishers, New Delhi.
3. Poonam Singh and Ashok Pandey. 2009. Biotechnology for agro-Industrial residues utilization. Springer.
4. Satyanarayana T and Johri B.N. 2005. Microbial diversity, Current Perspectives and Potential Applications, IK International.
5. Nair, L.N. 2007. Topics in Mycology and Pathology, New Central Book agency, Kolkata.
6. Sharma, P.D. 2011. Plant Pathology, Rastogi Publication, Meerut, India.
7. Mahendra Rai. 2009. Advances in Fungal Biotechnology. I.K. International Publishing House, New Delhi.

Books for Reference:

1. Alexopoulos, C.J., Mims, C.W., Blackwell, M. 1996. Introductory Mycology. 4th edition. John Wiley & Sons (Asia) Singapore.
2. Webster, J and Weber, R. 2007. Introduction to Fungi. 3rd edition. Cambridge University Press, Cambridge.
3. Sharma, O.P. 2011. Fungi and allied microbes The McGraw –Hill companies, New Delhi.
4. Burnett, J.H. 1971. The fundamentals of Mycology. ELBS Publication, London.
5. Bessey, E.A. 1979. Morphology and Taxonomy of fungi, Vikas publishing House Pvt. Ltd, New Delhi.
6. Dharani Dhar Awasthi. 2000. A Handbook of Lichens Vedams eBooks (P) Ltd. New Delhi.
7. Pelzer, M.J., Chan, E.C.S and Krieg, N.R. 1983. Microbiology, Tata McGraw Hill Publishing House, New Delhi.
8. Pandey, P.B. 2014. College Botany- 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.
9. Mishra, A. and Agarwal, R.P. 1978. Lichens – A Preliminary Text. Oxford and IBH.
10. Pandey, B.P. 2005. College Botany I: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S Chand & Company

Web Resources

1. <https://www.amazon.in/Fungi-Sarah-C-Watkinson-ebook/dp/B0199YDFDE>
2. <http://www.freebookcentre.net/biology-books-download/A-text-book-of-mycology-and-plant-pathology.html>
3. <http://www.freebookcentre.net/Biology/Mycology-Books.html>
4. <https://www.kobo.com/us/en/ebook/introduction-to-fungi>
5. <http://www.freebookcentre.net/biology-books-download/Introductory-Mycology.html>
6. [http://www.freebookcentre.net/biology-books-download/Fungi-\(PDF-15P\).html](http://www.freebookcentre.net/biology-books-download/Fungi-(PDF-15P).html)

Course Outcomes	On completion of this course, students will;	
CO1	Recognize the general characteristics of microbes, fungi and lichens and disease symptoms.	K1
CO2	Develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization.	K2
CO3	Identify the common plant diseases, according to geographical locations and devise control measures.	K3
CO4	Analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.	K4
CO5	Determine the economic importance of microbes, fungi and lichens.	K5

Mapping with Programme Outcomes:

Cos	Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3	2	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	1	2	1
CO 3	2	2	3	3	1	2	1	3	1	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	3	3	3	3	3

S - Strong (3) M - Medium (2) L - Low (1)

Programme Title	: B. Sc. Botany	
Course Title	: Plant Diversity II - Fungi, Bacteria, Viruses, Plant Pathology and Lichens – Major Practical - II	
Course Code	: 23UBOCCQ2	Hours/Week : 4
Semester	: II	Credits: 3

Syllabus

EXPERIMENTS

1. Microscopic observation of vegetative and reproductive structures of types prescribed in the syllabus through temporary preparations and permanent slides.
2. Identifying the micro slides relevant to the syllabus.
3. Herbarium specimens of bacterial diseases/photograph.
4. Protocol for mushroom cultivation.
5. Inoculation techniques for fungal culture (Demonstration only).
6. Study of economically important products obtained from fungi: Fungal biofertilizers, biopesticides, biofungicide (*Trichoderma*), edible mushroom/Yeast, organic acids (citric acid) enzymes (protease), antibiotics and vitamins.
7. Mycorrhiza: ecto-mycorrhiza and endo-mycorrhiza (Photographs)
8. Visit to fungal biotechnology laboratories.
9. Ultra structure of bacteria.
10. Simple and Gram staining of Bacteria
11. Structure of bacteriophage.
12. Micro-preparation of *Usnea* to study vegetative and reproductive structures.
13. Identifying the micro slides relevant to the syllabus.
14. Study of thallus and reproductive structures (apothecium) through permanent slides.
15. Economic importance of Lichens - Dye and perfume.

Programme Title : B. Sc. Botany

Course Title : Generic Elective II: Zoology II

Course Code : 23UBOGE2

Hours/Week : 3

Semester : II

Credits: 3

Course Objectives: The course aims

- To enable students to learn basic concepts relating to aspects of respiratory, circulatory, excretory nervous and sensory physiology.
- To enable students to comprehend the processes involved during development
- To enable students to learn basic concepts of immunity and the working of immune organs and familiarize them with the recommended vaccination Schedule.
- To enable students to comprehend the basic concepts of human genetics and patterns of inheritance.
- To enable students to learn about aspects of animal behaviour such as foraging, courtship, nest construction, parental care and learning.

Syllabus

Unit I (Hours : 12)

Respiration- Respiratory pigments and transport of gases. Mechanism of blood clotting. Types of excretory products – Ornithine cycle. Structure of neuron – Conduction of nerve impulse, Mechanism of vision and hearing.

Unit II (Hours : 12)

Fertilization, Cleavage, Gastrulation and Organogenesis of Frog; Placentation in mammals.

Unit III (Hours : 12)

Immunity Innate and Acquired – Active and Passive; Antigens and Antibodies; Immunological organs – responses in humans; Vaccination schedule.

Unit IV (Hours : 12)

Human Genetics: Human Chromosomes – Sex Determination in Humans; Patterns of Inheritance: Autosomal Dominant, Autosomal Recessive, X- linked, Y-linked, Mitochondrial, Multiple Allelic and Polygenic; Genetic Counselling.

Unit V (Hours : 12)

Animal Behaviour: Foraging, Courtship Behaviour, Shelter and Nest

Construction, Parental Care, Learning Behaviour.

Book for study:

1. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

Books for Reference:

1. Owen, J. A., Punt, J. & Stranford, S. A. - Kuby Immunology. New York: W.H. Freeman & Company.
2. Klug, W. S., Cummings, M. R. & Spencer, C - Concepts of Genetics. (12th ed.). New Jersey: Pearson Education.
3. Mathur, R.- Animal Behaviour. Meerut: Rastogi.
4. Verma P.S. & Agarwal - Developmental Biology, Chordata embryology S. Chand & Co.

Web resources:

1. www.sanctuaryasia.com
2. www.iaszoology.com

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Recall the parts and working of body organs and developmental stages, name the patterns of inheritance and list different types of animal behavior	PO1
CO2	Analyse the different developmental stages	PO1, PO2
CO3	Analyse the working of body and immune systems	PO4, PO6
CO4	Analyse the different patterns of inheritance	PO4, PO5, PO6
CO5	Relate the behaviour of animals to physiology. Analyse the different types of behavior	PO3, PO8

Mapping with Programme Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO 1	S	M	M	L	M	L	M	M
CO 2	M	S	M	L	M	L	M	L
CO 3	S	M	M	S	M	S	M	L
CO 4	S	M	S	S	S	M	M	L
CO 5	M	M	S	L	S	L	M	S

Programme Title : B. Sc. Botany

Course Title : Generic Elective II: Zoology Practical II

Course Code : 23UBOGEQ2

Semester : II

Hours/Week : 2

Credits: 2

Syllabus

MAJOR PRACTICAL

- a. Fish –Digestive System
- b. Fish - Nervous System
- c. Qualitative detection of carbohydrate, Protein and lipids.
- d. Qualitative detection of excretory products (Ammonia, Urea, Uric acid).
- e. Preparation and Examination of Haemin crystals

MINOR PRACTICAL

- a. ABO blood group.
- b. Estimation of pH (using pH paper)
- c. Human Mendelian traits
- d. Hanging drop technique to observe motility of bacteria
- e. Estimation of Haemoglobin in Human Blood

SPOTTERS

Identification and Description of :

- Amphioxus
- Shark,
- Scales of Fishes,
- Frog,
- Frog Egg,
- Frog Blastula
- Frog Gastrula.
- Pigeon- Quill feather.
- Autoclave
- Colorimeter
- Sphygmomanometer
- Normal karyotype male
- Normal karyotype female

- Klinefelter's syndrome
- Down's syndrome
- Thymus- T.S
- Lymph node – T.S

Programme Title	: B.A./ B. Sc./ B.Com.	
Course Title	: Skill Enhancement Course II: IKS – Traditional System of Plant Therapy	
Course Code	: 23UBOSEC2	Hours/Week : 2
Semester	: II	Credits: 2

Course Objectives : The course aims

- To understand about Indian system of medicine like Ayurveda and Siddha.
- To acquire knowledge about some herbal remedies for some common ailments.
- To know about herbal remedy for skin and hair problems.
- To gain knowledge about Aroma therapy and its uses.

Syllabus

Unit – I

Introduction, Basic principles of Ayurveda, Naturopathy and Siddha medicine- Panchabhutas - Tridhoshha concept – Vatta, Pitta and Kappa dhosha.

Unit – II

Preparation of Ayurvedic and Siddha medicine. Herbal remedies for some common infection diseases: Asthma, Chickenpox, Cold, Diarrhoea, Dental care, fever Worms.

Unit – III

Herbal remedies for some common disorders - Menstrual disorder, Hypertension, Jaundice, Diabetics and Ulcer (symptoms, causes and home remedies).

Unit – IV

Symptoms, causes and herbal remedies for Acne, Black heads, Corns, Warts, Boils, Stings and Bites (symptoms, causes and home remedies).

Unit – V

Dandruff, Premature graying and loss of Hair (symptoms, causes and home remedies). Aroma Therapy - Essential oils and its uses and Nutraceuticals.

Books for Study:

Jaibala,S. and G. Balakrishnan. 1975. *A Hand Book of Common Remedies Based on Siddha Medicine*. Ed. St. Louis Institute Press, Madras.

Books for Reference:

1. Vaidya Bhagwar Dash, 1978. *Fundamentals of Ayurvedic Medicine*, Konark, Publishers Pvt. Ltd. Delhi.
2. Saha, N.N.1981. *Herbal Remedies*. Universal Publication - New Delhi.
3. Bakhru, H.K. 1992. *Herbs that Heals*. Vision Books Ltd., New Delhi.

4. Prajapati, N.D., S.S. Purohit & U. Kumar.2003. *A Hand Book of Medicinal Plant*. Agrobios Publication, India.
5. Frank, H. & M. Martin. 2006. *Herbal Medicine and Botanical Medicinal fads*. Viva Books Pvt., Ltd., New Delhi.
6. Despandey, D.J.2008. *A Handbook of Herbal Remedies*. Agrobios, Jodhpur, India.

Web Resources:

<https://www.ayusante.com> > articles

Course Outcomes (CO): On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the practice of using herbs and their remedies to maintain health and cure diseases.	K3
CO2	Categorize Indian system of medicine such as Ayurveda, Siddha, Unani and Naturopathy.	K4
CO3	Choose different herbal remedies for skin and hair care.	K5
CO4	Prioritize about Aromatherapy and its applications.	K5
CO5	Improve skills in better usage of herbal medicines.	K6

Mapping of COs with POs

Cos \ POs	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S

L – Low; M – Medium; S – Strong

Programme Title : B.A./ B. Sc./ B.Com.

Course Title : Skill Enhancement Course II (NME II): Herbal Medicine

Course Code : 23UBOSEC2

Hours/Week : 2

Semester : II

Credits: 2

Course Objectives : The course aims

- To understand the nuances of medicinal plants and their phytoconstituents of commercial value
- To design and develop medicinal garden.
- To apply the knowledge to cultivate medical plants.
- To know the pharmacological importance of medicinal plants.
- To enlist phytochemicals and secondary metabolites of market and commercial value.

Syllabus

Unit I

Importance and Relevance of Herbal drugs in Indian System of Medicine, Pharmacognosy – Aim and scope.

Unit II

Medicinal gardening – Gardens in the Hills and plains; House gardens; plants for gardening – Poisonous plants – Types of plant poison; action of poisons; treatment for poisons, some poisonous plants; their toxicity and action.

Unit III

Adulteration of crude drugs and its detection – methods of adulteration; types of adulteration. Medicinal plants of export values; rejuvenating herbs; Medicinal uses of Non-flowering plants.

Unit IV

Botanical description and active principles of Root drugs; Rhizomes woods and bark drugs (Two examples for each plant organs).

Unit V

Botanical description and active principles of leaves; Flowers; Fruits seed and entire plants as drugs. Taxonomic study of some selected herbals (Two examples for each plant organs).

Books for Study:

1. Somasundaram, S. 1997. Medicinal botany (Maruthuvar Thavaraviyal) – (Tamil Medium Book).
2. Wallis, T.E. 1967. Text Books of Pharmacognosy. J. & A. Churchill Ltd., London,
3. Jains, S.K.. 1996. Medicinal Plants. Deep Publications, New Delhi.
4. Srivastava, A.K. 2006, Medicinal Plants, International Book Distributors, Dehradun.
5. Agarwal, O.P. 1985, Vol. II, Chemistry of organic – natural products. S Chand & Company, New Delhi.
6. Gamble, J.S. and Fisher, 1921, CEC I, II, III Flora of the Presidency, Madras Volumes. Mathew K.M., 1988, Flora of the Tamilnadu and Carnatic.

Books for Reference:

1. Nair, N.C and Henry, A.N. 1983, Flora of Tamil Nadu, India, Botanical Survey of India.
2. Chopra, R.N., Nagar S.L., and Chopra, I.C. 1956, Glossary of Indian Medicinal Plants.
3. Chopra, R.N., Chopra, I.C., Handa, K.L., and Kapur L.D., 1994, Indigenous drugs of India.
- Chopra, R.N., Badhuvar R.L and Gosh, G. 1965. Poisonous plants in India.
5. Miller, L and Miller, B. 2017. Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing. *Motilal Banarsidass, Fourth edition.*
- Patri, F and Silano, V. 2002. Plants in cosmetics: Plants and plant preparations used as ingredients for cosmetic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.

Web Resources:

1. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicine-natural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu
2. <https://www.springer.com/gp/book/9783540791157>
3. <https://www.gpatonline.com/gpat/book-reference-pharmacognosy>
4. https://www.researchgate.net/publication/334670695_Book_review-Herbal_Drug_Technology
5. <http://www.eurekaselect.com/node/173492/herbal-medicine-back-to-the-future>

Course Outcomes (CO): On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Define and describe the principle of cultivation of herbal products.	K1
CO2	Explain about the phytochemistry of economically important medicinal herbs	K2
CO3	Apply techniques for evaluation of drug adulteration through biological testing.	K3
CO4	Formulate the value added processing / storage / quality control for the better use of herbal medicine.	K4
CO5	Develop the skills for cultivation of plants and their value added processing/storage/quality control.	K5 & K6

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	2	1	2	1	3	2	1
CO 2	3	3	2	1	1	2	2	2	2	2
CO 3	2	2	1	3	1	2	1	3	2	1
CO 4	3	2	1	2	1	2	3	3	2	3
CO 5	3	3	2	2	1	1	3	3	1	3

S-Strong (3) M-Medium (2) L-Low (1)

Programme Title : I B.Sc. Botany

Course Title : Skill Enhancement Course III : Mushroom Cultivation

Course Code : 23UBOSEC3

Hours/Week : 2

Semester : II

Credits: 2

Course Objectives : The course aims

- To know about the food and energy value of mushrooms.
- To study the cultivation of different kinds of mushrooms.
- To know about the medicinal value of mushrooms.
- To make aware of diseases and storage of mushrooms.

Syllabus

Unit – I

Mushroom - morphology, types and advantages of mushroom cultivation. Medicinal and nutritional value of mushroom. Edible and poisonous mushroom

Unit – II

Mushroom cultivation: Spawn and spawning - different types of spawn - virgin, flake, brick and grain spawn. Methods of spawning - double layer, top, through, shake-up, active mycelium, spot and super spawning, storage of spawn. Casing - sterilization, Time of casing.

Unit – III

Techniques in mushroom cultivation - mushroom farm location, layout. Cultivation of Paddy straw mushroom - Standard bed, Hollow bed, Cage method - Substrates, spawn making methods and field cultivation.

Unit – IV

Oyster and White button Mushroom cultivation - substrates, spawn making methods and field cultivation. Factors affecting Mushroom cultivation.

Unit – V

Storage of mushrooms-blanching, steeping, sun-drying, canning, pickling and freeze drying. Do's and Dont's of mushroom growing. Diseases of mushrooms - Bacterial, Fungal, Viral diseases and other diseases caused by insects, mites and nematodes. Recipes of mushroom (omlette, tikka, chilly, soup and pickle).

Books for Study:

1. Pandey, R.K. and S.K. Ghosh. 1999. A Hand Book on Mushroom Cultivation. Emkay Publications, Delhi

Books for Reference:

1. Bahl, N. 1988. Hand book on Mushrooms. Oxford and IBH publishing Co.Pvt. Ltd., Delhi. (2nd Edition).
2. Suman, B.C. and V.P. Sharma. 2011. Mushroom Cultivation and Uses. Agrobios Publication, Jodhpur.
3. V.P. Sharma and B.C. Suman, 2011. Diseases and pests of Mushroom. Agrobios publication, Jodhpur.

Course Outcomes (CO): On completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	List out the significance of food and energy value of mushrooms.	K1
CO2	Illustrate cultivation methods of various kinds of mushrooms.	K2
CO3	Apply the medicinal values of mushrooms in terms of human welfare.	K3
CO4	Compile different kinds of diseases and mushroom preservation methods.	K6
CO5	Create different food recipes using mushrooms.	K6

Mapping of COs with POs

POs Cos	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	S	S	S
CO5	S	S	S	S	M

L – Low; M – Medium; S – Strong

Programme Title : B. Sc. Botany

Course Title : Plant Diversity- III Bryophytes and Pteridophytes

Course Code : 23UBOCC3

Hours/Week : 5

Semester : III

Credits: 5

Course Objectives: The course aims

- To enable the students to have an overview of Non-vascular and Vascular cryptogams.
- To understand the morphological diversity of Bryophytes and Pteridophytes.
- To know the evolution of Bryophytes and Pteridophytes.
- To understand the economic importance of the Bryophytes and Pteridophytes.
- To understand anatomy and reproduction of Bryophytes and Pteridophytes.

Syllabus

Unit I - (Hours:15)

BRYOPHYTES

General characters of Bryophytes, classification (Watson, 1971) (up to family).

Criteria for classification.

Structure, reproduction and life histories of the following classes each with a suitable example: Hepaticopsida (*Marchantia*),

Unit II - (Hours:15)

Structure, reproduction and life histories of the following classes each with a suitable example: Anthocerotopsida (*Anthoceros*) and Bryopsida (*Polytrichum*). Evolution of Bryophytes. Progressive evolution theory and Regressive evolution theory.

Economic importance of Bryophytes – Ecological importance (Pollution indicators and monitoring), Medicinal uses, horticulture and industrial uses.

Unit III - (Hours:15)

PTERIDOPHYTES

General Characters of Pteridophytes - Classification (Reimer, 1954). Criteria for classification. Apogamy and apospory.

Morphology, anatomy and reproduction of reproduction of the taxa belonging to each of the following classes: Psilotopsida (*Psilotum*), Lycopsidea (*Selaginella*).

Unit IV - (Hours:15)

Morphology, anatomy and reproduction of reproduction of the taxa belonging to each of the following classes: Sphenopsida (*Equisetum*), Pteropsida (*Marsilea*).

Homospory and heterospory. Heterospory and seed habit.

Unit V - (Hours:15)

Origin and evolution of Pteridophytes: origin of vascular cryptogams: Anthocerotean theory, Protocorm theory. Origin of sporophyte: Telome theory. Stelar Evolution. Economic importance of Pteridophytes- as food, as fibre, as horticulture plant, as weed, as biofertilizer, as medicine etc.

Books for Study:

1. Sharma, O.P. 2017. Bryophyta, MacMillan India Ltd. Delhi.
2. Alam, A. 2020. Contemporary Research on Bryophytes Book Series: Recent Advances in Botanical Science. 10.2174/97898114337881200101.
3. Alain Vanderpoorten. 2009. Introduction to Bryophytes, 1st Edition, Cambridge University Press.
4. Chopra, R. N. 2005. Biology of bryophytes. New Age International (P) Ltd. New Delhi, India.
- Prem Puri. 2001. Bryophytes– morphology growth and differentiation. Atma Ram & Sons. Lucknow, India.

Books for Reference:

1. Eames, A. 1963. Morphology of lower vascular plant, McGraw Hill, Chennai.
2. Parihar. N.S. 1967. An introduction of Embryophyta, Vol.III – Pteridophyta, Central book depot, Allahabad.
3. Smith, G.M. 1955. Cryptogamic Botany, Volume-II– McGraw Hill, Chennai
4. Sporne, K.L. 1976. Morphology of Pteridophytes, 4th edition, B.I. Publication. Chennai.
5. Watson, E.V. 1963. The structure and Life of Bryophytes. Hutchinson & Co, UK.
6. Parihar, N.S. 1991. Bryophytes. Central Book Depot, Allahabad.
7. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.

Web Resources:

1. <http://www.bryoecol.mtu.edu/>
2. <https://www.amazon.in/Introduction-Bryophytes-Alain-Vanderpoorten-ebook/dp/B007NFWQK>
3. <http://scitec.uwichill.edu.bb/bcs/bl14apl/bryo1.htm>
4. http://www.bsienviis.nic.in/Database/Pteridophytes-in-India_23432.aspx
5. <http://www.botany.ubc.ca/bryophyte/mossintro.html> 6. <http://www.botany.ubc.ca/bryophyte/mossintro.html>

Course outcomes	On completion of this course, students will;	
CO1	Recognize morphological variations of Bryophytes and Pteridophytes.	K1
CO2	Explain the anatomy and reproduction of Bryophytes and Pteridophytes.	K2
CO3	Compare and contrast the variations in the internal cellular organization, gametophyte and sporophyte of Bryophytes and Pteridophytes.	K3
CO4	Decipher the stages of plant evolution and their transition to land habitat.	K4
CO5	Access the useful role of Bryophytes and Pteridophytes.	K5

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	2	2	1	2
CO 2	3	3	3	2	3	2	2	3	2	2
CO 3	2	2	3	3	1	2	2	1	2	2
CO 4	3	3	3	3	3	2	3	3	2	3
CO 5	3	3	2	2	2	1	3	3	1	3

S-Strong (3)

M-Medium (2)

L-Low(1)

Programme Title	: B. Sc. Botany	
Course Title	: Core Practical III - Plant Diversity – III Bryophytes and Pteridophytes	
Course Code	: 23UBOCCQ3	Hours/Week : 4
Semester	: III	Credits: -

Syllabus

EXPERIMENTS

Bryophytes

1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Bryophytes genera included in the theory syllabus.
2. Hepaticopsida (*Marchantia*); Anthocerotopsida (*Anthoceros*) and Bryopsida (*Polytrichum*) (need not study developmental aspects).

Pteridophytes

3. Study of morphology, anatomy and structure of the vegetative and reproductive organs of Pteridophytes genera and fossils included in the theory syllabus. Psilotopsida (*Psilotum*), Lycopsida (*Selaginella*), Sphenopsida (*Equisetum*), Pteropsida (*Marsilea*). Identifying the micro slides relevant to the syllabus.

Botanical Excursion.

Programme Title : B. Sc. Botany

Course Title : Entrepreneurial Opportunities in Botany

Course Code : 23UBOSEC4

Hours/Week : 1

Semester : III

Credit: 1

Course Objectives: The course aims

- To enable students to understand about establishment of various ventures after graduates in Botany using medicinal plants, Biotechniques and marketing of bioproducts.
- To create a mindset among students to start their own companies for income generation.
- The students may understand about various fields of botany.
- To develop the concept of Entrepreneurial Opportunities in Botany.
- Describe the new strategies to describe marketing and business management strategy.

Syllabus

Unit I

INTRODUCTION TO ENTREPRENEURSHIP

Introduction to Entrepreneurship, Scope and identification of new ventures using plant resources, Mechanism of product selection and commercialization, General concept about the Govt. formalities, rules & regulation, Entrepreneurship skill development.

Unit II

TOOLS AND TECHNIQUES

Production of commercially viable plants through Plant tissue culture technique, Production of secondary metabolites, beverages, antibiotics.

Unit III

NEW VENTURE CREATION

Production of Biofertilizers, Vermicompost, Establishment of medicinal, herbal and zodiac gardens, Terrace & Kitchen garden, Spirulina and Azolla cultivation, Mushroom cultivation, Bonsai, Bouquet making, Terrarium.

Unit IV

PRODUCT DEVELOPMENT AND COMMERCIALIZATION

Product commercialization and business strategy, Dyes, Cosmetics and Perfumes, Areca Leaf Plates, cups & bags, Jute Products.

Unit V

BIO-BUSINESS PLANS, IPR AND BIOETHICS

Marketing and Business management strategy, Bank loan, Intellectual property rights, Patent laws - Bioethics and current legal issues, Marketing and public perceptions in product development – Technology licensing and branding concerns.

Books for study:

1. Gurinder Shahi. 2004. Bio-Business in Asia: How countries Can Capitalize on the Life Science Revolution, Pearson Prentice Hall, New Delhi, India.
2. Karthikeyan, S. and Arthur Ruf. 2009. Biobusiness, MJP Publications. Chennai, India.
3. Richard Oliver. 2000. The coming Biotech age: The Business of Biomaterials, McGraw Hill Publications, New York, USA.
4. Adams, C.R. Banford, K.M. and Early, M.P. 1993. Principles of Horticulture.
5. Sathe, T.V. 2004. Vermiculture and Organic farming, Daya Publishers.

Books for reference:

1. Robin Lowe and Sue Marriott 2009. Enterprise: Entrepreneurship and Innovation: Concepts, Contexts and Commercialization, Routledge Publisher, London, UK.
2. Peter F. Drucker, 2009. Innovation and Entrepreneurship, Harper Collins Publisher, New York, US.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides). Mukherjee D. Gardening in India, Oxford IBH publishing co, New Delhi.
4. Kumar, N. 1997. Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.
5. Webster, J and Weber, R. 2007. Introduction to Fungi, 3rd Ed Cambridge University Press, Cambridge.

Web source:

1. https://www.brainkart.com/article/Entrepreneurial-Botany_38321/
2. <https://www.youtube.com/watch?v=hnBla1FfcLo>
3. <https://www.slideshare.net/krishnashah5891004/ram-power-point-presentation>
4. http://www.brainkart.com/article/Economically-Useful-Plants-and-Entrepreneurial-Botany_38301
4. <https://www.ebooks.com/en-us/subjects/gardening/>
5. <https://www.amazon.in/Preservation-Techniques-Publishing-Technology-Nutrition-ebook/dp/B00RXCXB3Q>

Course outcomes	On completion of this course, students will;	
CO1	Relate to how various fields of botany could be understood with an entrepreneurial approach.	K1
CO2	Explain the concept of Entrepreneurial Opportunities in Botany.	K2
CO3	Make of the knowledge gained to start new venture using Plant tissue culture and plant products for commercial exploitations	K3
CO4	Decipher effective ways of making bioproducts like organic acids, solvents, beverages, enzymes, antibiotics, mushrooms, biogas and etc.	K4
CO5	Develop new strategies to describe marketing and business management strategy including the role of IPR and bioethics regulations for licensing.	K5 & K6

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	1	1	2	1	2	2	1	2
CO 2	3	3	2	2	3	1	2	3	1	2
CO 3	2	2	3	1	2	2	1	3	2	1
CO 4	3	3	1	2	3	2	3	3	2	3
CO 5	3	3	2	3	1	3	3	3	3	3

S-Strong (3) M-Medium (2) L-Low(1)

Programme Title : B. Sc. Botany

Course Title : Herbal Technology

Course Code : 23UBOSEC5

Hours/Week : 2

Semester : III

Credits: 2

Course Objectives: The course aims

- To provide students with knowledge of herbal drug industry, the quality of raw material, and guidelines for quality maintenance.
- To gain an insight into the commercially important secondary products and significance of bioprospecting.
- To understand various plants based drugs used in ayurvedha, unani, homeopathy, siddha etc.
- To apply the knowledge to cultivate medical plants.
- To know the pharmacological importance of medicinal plants.

Syllabus

Unit I

Herbal Technology: Definition and scope; Herbal medicines: history and scope; Traditional systems of medicine, and overview of AYUSH (Traditional Indian Systems of Medicine); Cultivation - harvesting - processing - storage of herbs and herbal products.

Unit II

Value added plant products: Herbs and herbal products recognized in India; Major herbs used as herbal medicines, nutraceuticals, cosmetics and biopesticides, their Botanical names, plant parts used, major chemical constituents.

Unit III

Pharmacognosy - Systematic position, botany of the plant part used and active principles of the following herbs: Tulsi, Ginger, Curcuma, Fenugreek, Indian Gooseberry, *Catharanthus roseus*, *Withania somnifera*, *Centella asiatica*, *Achyranthes aspera*, Kalmegh, Giloe (*Tinospora*), Saravar. Herbal foods, future of pharmacognosy.

Unit IV

Analytical pharmacognosy: Morphological and microscopic examination of herbs, Evaluation of drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

Unit V

Plant gene banks, Cultivation of Plants and their value added processing for use in herbal formulations, Introductory knowledge of Tissue culture and Micro propagation of some medicinal plants (*Withania somnifera*, neem and tulsi).

Books for study:

1. AYUSH (www.indianmedicine.nic.in). About the systems—An overview of Texts Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India.
2. Evans, W.C. 2009: Trease and Evans PHARMACOGNOSY. 16th Edition, SAUNDERS / Elsevier.
3. Sivarajan, V.V. and India, B. 1994. Ayurvedic Drugs and Their Plant Sources.. Oxford & IBH Publishing Company, 1994 - Herbs - 570 pages.
4. Miller, L. and Miller, B. 2017. Ayurveda & Aromatherapy: The Earth Essential Guide to Ancient Wisdom and Modern Healing. Motilal Banarsidass,; Fourth edition .
5. Kokate, C.K. 2003. Practical Pharmacognosy. Vallabh Prakashan, Pune.

Books for reference:

1. Agarwal, P., Shashi, Alok., Fatima, A. and Verma, A. 2013. Current scenario of Herbal Technology worldwide: An overview. Int J Pharm Sci Res; 4(11): 4105-17.
2. Arber, Agnes. 1999. Herbal Plants and Drugs. Mangal Deep Publications, Jaipur.
3. Varzakas, T., Zakyntinos, G, and Francis Verpoort, F. 2016. Plant Food Residues as a Source of Nutraceuticals and Functional Foods. Foods 5 : 88.
4. Aburjai, T. and Natsheh, F.M. 2003. Plants Used in Cosmetics. Phytotherapy Research 17 :987- 1000.
5. Patri, F. and Silano, V. 2002. Plants in cosmetics: Plants and plant preparations used as ingredients for cosmetic products - Volume 1. ISBN 978-92-871-8474-0, pp 218.

Web source:

1. <https://www.kopykitab.com/Herbal-Science>
2. https://kadampa.org/books/free-ebook-download-howtotyl?gclid=CjwKCAiA6vXwBRBKEiwAYE7iS5t8yenurCIUCTdV9olKo9TbyAh4fsoFqPYWGs5qBTbytD22z7lo0BoCYnUQAvD_BwE
3. https://www.barnesandnoble.com/b/free-ebooks/nook-books/alternative-medicinenatural-healing/herbal-medicine/_/N-ry0Z8qaZ11iu
4. <http://cms.herbalgram.org/heg/volume8/07July/HerbalEBooks.html?t=1310004932&ts=1579066352&signature=1dd0d5aef818b19bcdcd6c063a78e404>
5. <https://www.dattanibookagency.com/books-herbs-science.html>
<https://www.springer.com/gp/book/9783540791157>

Course outcomes	On completion of this course, students will;	
CO1	Define and describe the principle of cultivation of herbal products.	K1
CO2	List the major herbs, their botanical name and chemical constituents.	K2
CO3	Apply techniques for monitoring drug adulteration through the biological testing.	K3
CO4	Analyze and decipher the significance of various methods of harvesting, drying and storage of medicinal herbs.	K4
CO5	Develop the skills for cultivation of plants and their value added processing / storage.	K5 & K6

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3	3	3	2	3	2
CO 2	3	3	3	3	3	3	3	1	3	1
CO 3	3	3	3	3	3	3	3	2	3	2
CO 4	3	3	3	3	3	3	3	1	3	1
CO 5	3	3	3	3	3	3	3	1	3	1

S-Strong (3)

M-Medium (2)

L-Low(1)

Programme Title : B. Sc. Botany

Course Title : Generic Elective III: Chemistry I

Course Code : 23UBOGE3

Hours/Week : 3

Semester : III

Credits: 3

Course Objectives: The course aims at providing knowledge on

- basics of atomic orbitals, chemical bonds, hybridization and fundamentals of organic chemistry
- concepts of nuclear chemistry and industrial chemistry
- importance of specialty drugs and artificial sweeteners separation and purification techniques.

Syllabus

Unit I (Hours: 15)

Chemical Bonding and Nuclear Chemistry

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and non-bonding orbitals. MO diagrams for Hydrogen, Helium, Nitrogen; discussion of bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers-Differences between chemical reactions and nuclear reactions- group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes – carbon dating, rock dating and medicinal applications.

Unit II (Hours: 15)

Industrial Chemistry

Fuels: Fuel gases: natural gas, water gas, semi water gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required).

Silicones: Synthesis, properties and uses of silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, superphosphate, triple superphosphate.

Unit III (Hours: 15)

Fundamental Concepts in Organic Chemistry

Hybridization: Orbital overlap hybridization and geometry of CH_4 , C_2H_4 , C_2H_2 and C_6H_6 . Polar effects: Inductive effect and consequences on k_a and k_b of organic

acids and bases, electromeric, mesomeric, hyper conjugation and steric-examples and explanation.

Reaction mechanisms: Types of reactions- aromaticity-aromatic electrophilic substitution; nitration, halogenation, Friedel-Craft's alkylation and acylation.

Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

Unit IV (Hours: 15)

Drugs and Speciality Chemicals

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial Sweeteners viz., saccharin, aspartame and cyclamate; Organic halogen compounds viz., Freon, Teflon.

Unit V (Hours: 15)

Analytical Chemistry

Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization. Chromatography: principle and applications of column, paper and thin layer chromatography.

Books for Study

1. Veeraiyan, V, *Textbook of Ancillary Chemistry*; High mount publishing house, Chennai, 1st Ed., 2009.
2. Vaithyanathan, S, *Text book of Ancillary Chemistry*; Priya Publications, Karur, 2006.
3. Arun Bahl, Bahl, B. S, *Advanced Organic Chemistry*; S. Chand and Company, New Delhi, 23rd Ed., 2012.
4. Soni, P. L, Chawla, H. M, *Text Book of Inorganic Chemistry*; Sultan Chand & sons, New Delhi, 29th Ed., 2007.

Books for Reference

1. Soni, P.L,& Mohan Katyal, *Text book of Inorganic chemistry*; Sultan Chand and Company, New Delhi, 29th Ed., 2007.
2. Sharma, B. K, *Industrial Chemistry*; GOEL publishing house, Meerut, 16th Ed., 2014.
3. Jayashree Gosh, *Fundamental Concepts of Applied Chemistry*, Sultan & Chand, 1st Ed., 2006.

Course	On completion of this course, students will;	
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outcomes		
CO1	Describe the theories of chemical bonding, nuclear reactions and its applications.	K1
CO2	Evaluate the efficiencies and uses of various fuels and fertilizers.	K2
CO3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	K3
CO4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.	K4
CO5	Identify an appropriate method for the separation of chemical components	K5 & K6

Title of the Course	GENERIC ELECTIVE - CHEMISTRY PRACTICAL						
Course No.	Generic Elective - III Practical						
Category	Generic Elective	Year	2	Credit	2	Course Code	23UBOGECQ3
		Semester	III				
Instructional hours per week	Lecture	Tutorial		Lab Practice		Total	
	-	-		2		2	
Prerequisites	Higher Secondary Chemistry						
Objectives of the course	This course aims to provide knowledge on the <ul style="list-style-type: none"> basics of preparation of solutions. principles and practical experience of volumetric analysis. 						
Course Outline	Volumetric analysis <ol style="list-style-type: none"> 1. Estimation of sodium hydroxide using standard sodium carbonate. 2. Estimation of hydrochloric acid using standard oxalic acid. 3. Estimation of ferrous sulphate using standard Mohr's salt. 4. Estimation of oxalic acid using standard ferrous sulphate. 5. Estimation of potassium permanganate using standard sodium hydroxide. 6. Estimation of magnesium using EDTA. 7. Estimation of ferrous ion using diphenyl amine as indicator. 						
Reference Book	Venkateswaran, V, Veerasamy, R, Kulandaivelu, A.R, <i>Basic Principles of Practical Chemistry</i> ; Sultan Chand & sons, 2 nd Ed., 199.						
Course Outcomes							
On completion of the course the students should be able to							
On successful completion of the course the students should be able to							
CO1: gain an understanding of the use of standard flask and volumetric pipettes, burette.							
CO2: design, carry out, record and interpret the results of volumetric titration.							
CO3: apply their skill in the analysis of water /hardness.							
CO4: analyze the chemical constituents in allied chemical products.							

Programme Title	: B. Sc. Botany	
Course Title	: Environmental Studies	
Course Code	: 23UEVSC	Hours/Week : 1
Semester	: III	Credits: -

Course Objectives

- To educate the students regarding the environmental issues and problems.
- To give an exposure towards the scientific and socio – economic dimensions of the environment.
- To impart and enhance the basic knowledge about environment and develop concern towards it.
- To develop the ability to evaluate the measures for the improvement and protection of environment.
- To sensitize the students on the various environmental issues.
- To integrate different disciplines and fields that intersect with environmental concerns
- To make the younger generations aware of the values of natural resources.

Course Outcomes

- Demonstrate critical thinking skills in relation to environmental issues.
- Develop an integrative approach to environmental issues with a focus on sustainability.
- Bring an awareness, knowledge and appreciation of intrinsic values of ecological processes and communities.
- Reflect critically about their roles and identities as citizens, consumers and an environmentalist in the complex, interconnected world.
- Apply systems, concepts and methodologies to analyse and understand interactions between social and environmental processes.
- Understand the transactional character of environmental problems and ways of addressing them, including interactions across local to global scales.

UNIT I - FUNDAMENTALS

Environment-Definition: Scope, Structure and Function of Ecosystems- Producers. Consumers and Decomposers-Energy flow in the Ecosystem-Ecological Succession-Food Chain, Food Webs and Ecological Pyramids-Concept of Sustainable Development.

UNIT II - NATURAL RESOURCES

Renewable Resources-Air, Water, Soil, Land and Wildlife resources; Non- Renewable Resources-Minerals, Coal, Oil and Natural Gas; Environmental problems related to the Extraction and use of Natural Resources.

UNIT III- BIODIVERSITY

Biodiversity – Definition – values-consumption use, Productive social, Ethical, Aesthetic and option Values Threats to Biodiversity-Hotspots of Biodiversity-conservation of Biodiversity: In-situ,

Ex-situ, Bio-Wealth National and Global Level.

UNIT IV- ENVIRONMENTAL POLLUTION

Definition-Causes, Effects and Mitigation Measures-Air, Water and Soil Pollution. Noise Pollution, Thermal pollution, Nuclear Hazards, Solid Wastes, Acid Rain, Climate Change and Global Warming, Environmental Laws and Regulations in India-Earth Summit.

UNIT V-POLLUTION AND ENVIRONMENT

Population Explosion-Environment and Human Health-HIV/AIDS-Women and Child Welfare- Resettlement and rehabilitation of people, Role of Information Technology in Environmental Health. Environmental Awareness. Environmental Disaster Management - Fire Safety and Prevention.

Field work

- Visit to 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 ecosystem-pond, river, Delhi ridge, etc.,(Equal to 5 lectures)

References:

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.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. Principles of Conservation Biology Sunderland: Sinauer Associates, 2006.
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. McNeill, 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 Treatment. 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.

**CORE-VII- PLANT DIVERSITY IV :GYMNOSPERMS,PALEOBOTANY
AND EVOLUTION**

Title of the Course		PLANT DIVERSITY IV-GYMNOSPERMS, PALEOBOTANY AND EVOLUTION						
Paper Number		CORE VI						
Category	Core	Year	II	Credits	5	Course Code	23UBOCC4	
		Semester	IV					
Instructional Hours per week		Lecture	Tutorial		Lab Practice		Total	
		6	-		-		6	
Pre-requisite		Students should know about the fundamentals of Gymnosperms, fossil records and evolution.						
Learning Objectives								
C1		To enable the students to understand thallus organization,						
C2		To enable the students to understand internal and the reproductive structures of Gymnosperms and the importance of evolution.						
C3		to acquaint students with evidences of the past history of plant groups and significance of the fossilization.						
C4		To know the scope of paleobotany, types of fossils and geological time scale.						
C5		Understand the various fossil genera representing different fossil groups.						
Course outcomes: On completion of this course, the students will be able to: CO		Programme Outcomes						
1. Relate to the general characteristics of Gymnosperms and fossil forms		K1						
2. Explain about the morphology and anatomy Gymnosperms.		K2						
3. Compare and contrast the reproductive structures of Gymnosperms & fossil forms.		K3						
4. Analyze the anatomy and reproduction Gymnosperms along with their ecological and economical importance.		K4						
5. Determine the various fossilization methods and their significance in paleobotany.		K5						

UNIT	CONTENTS
I	GYMNOSPERMS General characteristics of Gymnosperms. Classification of Gymnosperms (Sporne, 1954) (up to family). Criteria for classification. Economic importance of Gymnosperms with special reference to oil, resin, timber, etc.
II	GYMNOSPERMS Morphology, anatomy and reproduction of the taxa belonging to each of the following orders: Cycadales (<i>Cycas</i>) and Gnetales (<i>Gnetum</i>).
III	PALEOBOTANY Introduction to fossils and fossilization processes such as compression, casts, molds, petrification, impressions and coal balls. Geological time scale. Radiocarbon dating.
IV	PALEOBOTANY Study of the following fossils: <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Calamites</i> and <i>Williamsonia sewardiana</i> .
V	EVOLUTION Evolution - origin of life, chemosynthetic theory - evidences (any five). Theories of evolution - Darwin, Lamark and De veries, modern synthetic theory. Concept of species - Allopatric and sympatric.
Extended Professional Component	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
(is a part of internal component only, Not to be included in the External Examination question paper)	
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Recommended Texts	<ol style="list-style-type: none"> 1. Gupta, M.N. 1972. The Gymnosperms (2nd Edition) Shiva Lal Agarwala & Co., Agra. 2. Vashista, P.C. 1976. Gymnosperms, S.Chand & Co. New Delhi. 3. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India. 4. Anil Kumar. 2006. Gymnosperms. S. Chand & Company Pvt. Ltd. New Delhi. 5. Bhatnagar S.P and Alok Moitra. 2013. Gymnosperms. Publisher: New Age International Pvt Ltd Publishers. New Delhi.
Reference Books	<ol style="list-style-type: none"> 1. Sporne, K.R.1991. The Morphology of Gymnosperme. B.I. Publications, New Delhi. 2. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms, New Age Int. Pvt. Ltd., New Delhi. 3. Stewart, W.N and Rathwell, G.W. 1993. Paleobotany and the Evolution of Plants. Cambridge University Press. 4. Raup, D.M and Steven, M. Stanley. 2004. Principles of paleontology. San Francisco: W.H. Freeman, 1971. 5. Bhatnagar S.P and Alok Moitra. 2013. Gymnosperms. Publisher: New Age International Pvt Ltd Publishers. New Delhi.
Web Resources	<ol style="list-style-type: none"> 1. https://books.google.co.in/books?hl=en&lr=&id=Pn7CAAAQBAJ&oi=fnd&pg=PA1&dq=Introduction+to+Gymnosperms&ots=sfYSzCL02&sig=ysX1KRvetV0bAza4Sq6RWau4XU8&redir_esc=y#v=onepage&q=Introduction%20to%20Gymnosperms&f=false 2. https://books.google.co.in/books/about/Botany_for_Degree_Gymnosperm_Multicolor.html?id=HTdFYFNxnWQC&redir_esc=y 3. https://books.google.co.in/books/about/Gymnosperms.html?id=4dvyNckni8wC 4. https://arboretum.harvard.edu/wp-content/uploads/2013-70-4-beyond-pine-cones-an-introduction-to-gymnosperms.pdf 5. https://www.palaeontologyonline.com/

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	1	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	3	2	3
CO 3	3	3	2	2	1	2	1	3	1	3
CO 4	3	3	3	3	3	2	3	3	3	3
CO 5	3	3	2	3	2	2	1	3	1	3

S-Strong (3)

M-Medium (2)

L-Low(1)

**CORE-PRACTICAL III -PLANT DIVERSITY IV GYMNOSPERMS,
PALEOBOTANY AND EVOLUTION - PRACTICAL**

Title of the Course		PLANT DIVERSITY IV- GYMNOSPERMS, PALEOBOTANY EVOLUTION – MAJOR PRACTICAL-III (including Core V+VI)						
Paper Number		CORE VII						
Category	Core	Year	II	Credits	3	Course Code	23UBOCCQ3	
		Semester	IV					
Instructional Hours per week		Lecture		Tutorial		Lab Practice		Total
		-		-		2		2
Pre-requisite		Students should be familiar with the fundamentals of Gymnosperms, Paleobotany.						
Learning Objectives								
C1		To enable students, observe and record the morphological features ofselected species of Gymnosperms.						
C2		To enable students, observe and record the anatomical features ofselected species of Gymnosperms.						
C3		To develop the skill of preparation of microslides of the gymnosperm samples.						
C4		To enable students to gain insights into the basics of paleobotany and methods of fossilization.						
C5		To understand the anatomy of the fossil plants through microscopy.						
Course outcomes: On completion of this course, the students will be able to: CO		Programme Outcomes						
1. Analyze and observe and record the morphological features of selected species of Gymnosperms..		K1						
2. Describe the structure of fossil forms prescribed in the syllabus.		K2						
3. Identify and Illustrate the morphological and anatomical features of gymnosperms.		K3						
4. Develop comprehensive skills in sectioning and micro preparation.		K4						

5. Interpret the significance of reproductive structures in gymnosperms.	K5
EXPERIMENTS 1. Study of morphology, anatomy and structure of the vegetative and reproductive organs of <i>Cycas</i> and <i>Gnetum</i> . 2. Identifying the micro slides relevant to the syllabus. 3. Field visit to study the habitat (Hill station). 4. Study the following fossil members: <i>Rhynia</i> , <i>Lepidodendron</i> , <i>Lepidocarpon</i> , <i>Calamites</i> and <i>Williamsonia seawardiana</i> through permanent slides. 5. Photograph of evolution scientists: Darwin, Lamark and De veries. 6. Photograph related to evolution theory: Darwinism, Lamarkism and De veries, modern synthetic theory.	
Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	1. Sharma O.P and S, Dixit. 2002. Gymnosperms. Pragati Prakashan. 2. Gangulee, H.C and A.K. Kar. 2013. College Botany. Vth Edition. S. Chand.
	3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi. 4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York. 5. Bhatnagar, S.P and Moitra, A. 1996. Gymnosperms. New Age International Publishers, New Delhi, India.
Reference Books	1. Smith, G.M. 1955. Cryptogamic Botany Vol.II. Tata McGraw Hill. New Delhi. 2. James.W. Byng. 2015. The Gymnosperms practical hand book. A practical guide to extant families and genera of the world. Published by plant Gateway, Tol Bot Street, Herford, SG137BX, United Kingdom. 3. Sharma, O.P. 2012. Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi. 4. Chamberlain, C.J. 1934. Gymnosperms: Structure and Evolution. Chicago Reprinted 1950). New York. 5. Kirkaldy, J.E. 1963. The study of Fossils. Hutchinson Educational, London.

Web resources	<ol style="list-style-type: none"> 1. https://www.google.co.in/books/edition/Gymnosperms/3YrT5E3Erm8C?hl=en&gbpv=1&dq=gymnosperms&printsec=frontcover 2. https://www.amazon.in/Paleobotany-Biology-Evolution-Fossil-Plants/dp/0123739721 3. https://books.google.co.in/books/about/Paleobotany.html?id=HzYUAQAAIAAJ 4. https://trove.nla.gov.au/work/11471742?q&versionId=46695996 5. http://www.freebookcentre.net/Biology/Evolutionary-Biology-Books.html.
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Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2	1	2	2	2	3
CO 2	3	3	2	2	3	3	2	3	2	2
CO 3	2	2	3	3	1	2	1	3	3	3
CO 4	3	3	3	3	3	2	2	3	3	3
CO 5	3	3	2	2	3	3	2	3	2	2

S-Strong (3)

M-Medium (2)

L-Low(1)

Title of the Course	CHEMISTRY-II						
Course No.	Elective- IV (GE)						
Category	Generic Elective	Year Semester	II IV	Credits	3	Course Code	23UBOGEC4
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	-	-		3		
Prerequisites	Chemistry I for Biological Sciences						
Objectives of the course	This course aims to provide knowledge on <ul style="list-style-type: none"> • Nomenclature of coordination compounds and carbohydrates. • Amino Acids and Essential elements of biosystem • Understand the concepts of kinetics and catalysis • Basics and types of polymers • Provide fundamentals of photochemistry 						
Course Outline	<div> UNIT I 9 Hours Co-ordination Chemistry and Water Technology Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Chelation - Biological role of Hemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis. Water Technology: Hardness of water, determination of hardness of water using EDTA method, zeolite method-Purification techniques – BOD and COD. </div> <div> UNIT II 9 Hours Carbohydrates Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose. </div> <div> UNIT III 9 Hours Amino Acids and Essential elements of biosystem Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins- classification – structure - Colour reactions – Biological functions – nucleosides - nucleotides – RNA and DNA – structure. Essentials of trace metals in biological system-Na, Cu, K, Zn, Fe, Mg. </div> <div> UNIT IV 9 Hours Polymer chemistry Polymers - monomers, classification of polymers, types of polymerizations- addition and condensation polymerization. Natural polymers: polysaccharides - (eg., starch and cellulose). Polyhydrocarbon (eg., natural rubber) and polyamide (eg., protein). Synthetic polymers: preparation and applications of polyethylene, polypropylene, polyester, polyvinylchloride, polyvinylcarbonate, polyamide, polytetrafluoroethylene, synthetic rubber, vulcanization of rubber. </div>						

	UNIT V 9 Hours Photochemistry Grothus - Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).
Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)	Questions related to the above topics, from various competitive examinations UPSC/ JAM /TNPSC others to be solved (To be discussed during the Tutorial hours)
Skills acquired from this course	Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.
Recommended Text	<ol style="list-style-type: none"> 1. Veeraiyan V, <i>Textbook of Ancillary Chemistry</i>; High mount publishing house, Chennai, 1st Ed., 2009. 2. Vaithyanathan S, <i>Text book of Ancillary Chemistry</i>; Priya Publications, Karur, 2006. 3. Arun Bahl, Bahl B.S, <i>Advanced Organic Chemistry</i>; S.Chand and Company, New Delhi, 23rd Ed., 2012. 4. Soni P.L, Chawla H M, <i>Text Book of Organic Chemistry</i>; Sultan Chand & sons, New Delhi, 29th Ed., 2007. 5. Gowariker V R, Viswanathan N V, Jayadev Sreedhar, <i>Polymer Science</i>, Wiley Eastern Ltd, 1986.
Reference Books	<ol style="list-style-type: none"> 1. Arun Bahl, Bahl B.S, <i>Advanced Organic Chemistry</i>; S.Chand and Company, New Delhi, 23rd Ed., 2012. 2. Soni P L, Chawla H M, <i>Text Book of Organic Chemistry</i>; Sultan Chand & sons, New Delhi, 29th Ed., 2007. 3. Soni P L, Mohan Katyal, <i>Text book of Inorganic chemistry</i>; Sultan Chand and Company, New Delhi, 20th Ed., 2007. 4. Puri B R, Sharma L R, Pathania M S, <i>Text book Physical Chemistry</i>; Vishal Publishing Co., New Delhi, 47th Ed., 2018. 5. Sharma B K, <i>Industrial Chemistry</i>; GOEL publishing house, Meerut, sixteenth edition, 2014.

Course Outcomes**On completion of the course the students should be able to**

- CO 1:** write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.
- CO 2:** explain the preparation and property of carbohydrate.
- CO 3:** enlighten the biological role of transition metals, amino acids and nucleic acids.
- CO 4 :** acquire knowledge about the polymer and its types .
- CO 5:** outline the various type of photochemical process.

Title of the Course	CHEMISTRY PRACTICAL-II						
Course No.	Elective-IV (GE)						
Category	Generic Elective	Year	II	Credits	2	Course Code	23UBOGECQ4
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice			Total	
	-	-	2			2	
Prerequisites							
Objectives of the course	This course aims to provide knowledge on <ul style="list-style-type: none"> • identification of organic functional groups • different types of organic compounds with respect to their properties. • determination of elements in organic compounds. 						
	SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS The analysis must be carried out as follows: <ol style="list-style-type: none"> Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides (mono & di), aldehyde and glucose]. Detection of elements (N, S, Halogens). To distinguish between aliphatic and aromatic compounds. To distinguish – Saturated and unsaturated compounds. 						
Reference Books	Venkateswaran V, Veerasamy R, Kulandaivelu A R, <i>Basic Principles of Practical Chemistry</i> ; Sultan Chand & sons, 2 nd Ed., 1997.						
Course Outcomes On completion of the course the students should be able to CO1: observe the physical state, odour, colour and solubility of the given organic compound. CO2: identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis. CO3: analyze the given organic compound and explain the reactions behind it.							

SKILL ENHANCEMENT COURSES SEC VI
FERMENTATION TECHNOLOGY

Title of the Course		FERMENTATION TECHNOLOGY					
Paper Number		Skill Enhancement VI					
Category	SEC	Year	II	Credits	2	Course Code	23UBOSEC6
		Semester	IV				
Instructional Hours per week		Lecture	Tutorial		Lab Practice	Total	
		2	-		-	2	
Pre-requisite		To students to know about the various fermentation technology.					
Learning Objectives							
C1		To appreciate the significance of microbes synthesizing fermented products.					
C2		To gain insights on safety and quality control in large scale production of fermentative products.					
C3		To design and operation of industrial practices in mass production of fermented products.					
C4		To know about the various fermentation technology.					
C5		To learn about the bioproduct recovery.					
Course outcomes: On completion of this course, the students will be able to: CO		Programme Outcomes					
1. Enumerate the significance of industrially useful microbes.		K1					
2. Explain the design and operation of industrial practices in mass production of fermented products.		K2					
3. Explain the process of maintenance and		K3					

preservation of microorganisms.	
4. Analyze the various aspects of the fermentation technology and apply for fermentative production.	K4
5. Validate the experimental techniques for microbial production of enzymes: amylase and protease, bio product recover.	K5 & K6
UNIT	CONTENTS
I	Preparation of microbial culture, Preparation and sterilization of fermentation media. Isolation and improvement of industrially important microorganisms (<i>Saccharomyces sp.</i> and <i>Penicillium sp.</i>).
II	Maintenance and preservation of microorganisms, Metabolic regulations and overproduction of metabolites. Kinetics of microbial growth and product formation.
III	Scope and opportunities of fermentation technology. Principles of fermentation: Submerged, solid state, batch, fed-batch and continuous culture.
IV	Fermentative production of vinegar, alcohol (ethanol), acids (citric acid), amino acids (glutamic acid) and antibiotics (<i>Penicillin</i>).
V	Microbial production of enzymes: Amylase and Protease. Bioproduct recovery.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC /others to be solved (To be discussed during the Tutorial hour)
question paper)	
Skills acquired from this course	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill
Recommended Texts	<ol style="list-style-type: none"> 1. Waites M.J. 2008. Industrial Microbiology: An Introduction, 7th Edition, Blackwell Science, London, UK. 2. Prescott S.C., Dunn C.G., Reed G. 1982. Prescott & Dunn's Industrial Microbiology, 4th Edition, AVI Pub. Co., USA. 3. Reed G. 2004. Prescott & Dunn's industrial microbiology, 4th Edition, AVI Pub. Co., USA. 4. JR Casida L.E. 2015. Industrial Microbiology, 3rd Edition, New Age International (P) Limited Publishers, New Delhi, India. 5. Waites M.J., Morgan N.L., Rockey J.S. and Higon G. 2001. Industrial Microbiology: An Introduction. 1st Edition, Blackwell Science, London, UK. 6. Pelczar M.J., Chan E.C.S. and Krieg N.R. 2003. Microbiology. 5th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Reference Books	<ol style="list-style-type: none"> 1. Peter F Stanbury, Allan Whitaker, Stephen J Hall. 2016. Principles of Fermentation Technology. Butterworth-Heinemann Press. UK. 2. Peppler, H. J. D. Perlman. 2014. Microbial Technology: Fermentation Technology. Academic Press. 3. T. El-Mansi, C. Bryce, Arnold L. Demain, A.R. Allman. Fermentation Microbiology and Biotechnology. Second Edition. 2006. CRC Press, USA. 4. Hongzhang Chen. Modern Solid State Fermentation: Theory and Practice. 2013. Springer Press, Germany. 5. John E. Smith. Biotechnology. 2009. Cambridge University Press. UK. 6. Celeste M. Todaro, Henry C. Vogel. 2014. Fermentation and Biochemical Engineering Handbook. William Andrew Press. Norwich, NY. 7. Lancini, G. R. Lorenzetti. 2014. Biotechnology of Antibiotics and other Bioactive Microbial Metabolites. Springer publications, Germany.
Web resources	<ol style="list-style-type: none"> 1. https://ebooks.foodtechlearning.xyz/2020/12/principal-of-fermentation-technology-by.html 2. https://www.amazon.in/Principles-Fermentation-Technology-Peter-Stanbury-ebook/dp/B01LMDYFNQ 3. https://www.amazon.in/Principles-Fermentation-Technology-Peter-Stanbury-ebook/dp/B01E3IC73W 4. https://www.pdfdrive.com/principles-of-fermentation-technology-e189052809.html 5. https://www.ebooks.com/en-us/book/2698294/principles-of-fermentation-technology/peter-f-stanbury/

Mapping with Programme Outcomes:

Cos	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	1	2
CO 2	3	3	2	2	1	2	3	2	2	3
CO 3	2	2	3	1	1	1	2	3	1	2
CO 4	3	3	2	1	3	2	1	3	2	1
CO 5	3	3	2	1	2	2	3	3	2	3

S-Strong (3)

M-Medium (2)

L-Low(1)

SKILL ENHANCEMENT COURSES SEC VII

ENVIRONMENTAL IMPACT ANALYSIS

Title of the Course	ENVIRONMENTAL IMPACT ANALYSIS						
Paper Number	Skill Enhancement VII						
Category	Elective	Year	II	Credits	1	Course Code	23UBOSEC7
		Semester	IV				
Instructional Hours per week		Lecture		Tutorial	Lab Practice	Total	
		2		-	-	2	
Pre-requisite		To students to know about the environmental impact assessment.					
Learning Objectives							
C1	To understand about the theory and practice of environmental impact assessment.						
C2	To develop skills in identifying and solving problems of environmental concerns.						
C3	Define and classify Environmental Impacts and the terminology.						
C4	Understands the environmental Impact assessment procedure.						
C5	List and describe environmental audits.						
Course outcomes: On completion of this course, the students will be able to: CO	Programme Outcomes						
1. Enumerate the fundamental concepts and significance of environmental impact assessment.	K1						
2. Explain the important steps of EIA process.	K2						

3. Interpret the environmental appraisal and procedures in India.	K3
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4. Decipher how to prepare the various documents required by state and federal regulations.	K4
5. Develop their own perspectives on impact assessment and be able to solve problems related to environment.	K5 & K6

UNIT	CONTENTS
I	Origin and Development Purpose and aim, core values and principles, History of EIA development, Environmental Management Plan, Environmental Impact Statement, Scope of EIA in Project planning and Implementation.
II	EIA Process Components of EIA, EIA Methodology- Screening, Scoping, Baseline data, Impact Identification, Prediction, Evaluation and Mitigation, Case Study.
III	Techniques of Assessment-Cost-benefit Analysis. Impact on Environmental component: air, noise, water, land, biological, social and environmental factors.
IV	Main participants in EIA Process Role of Project proponent, environmental consultant, PCBs, PCCs, public and IAA. Public participation.
V	Environmental Appraisal and Procedures in India and EIA Methodology, indicators and mitigation, Environmental Audit of different environmental resources, Risk Analysis.

Extended Professional Component (is a part of internal component only, Not to be included in the External Examination question paper)	Questions related to the above topics, from various competitive examinations UPSC / TRB / NET / UGC – CSIR / GATE / TNPSC / others to be solved (To be discussed during the Tutorial hour)
Skills acquired from this	Knowledge, Problem Solving, Analytical ability, Professional Competency, Professional Communication and Transferrable Skill

Course	
	<ol style="list-style-type: none"> 1 Morris, P. and Therivel, R. 1995. Methods of Environmental Impact Assessment, UCL Press, London. 2. Petts, J. 1999. Handbook of Environmental Impact Assessment, volume 1 and 2, Blackwell Science, Oxford. 3. Therivel, R. and Partidario, M.R. 1996. The Practice of Strategic Environmental Assessment, Earthscan, London. 4. Vanclay, F. and Bronstein, D.A. 1995. Environmental and Social Impact Assessment, Wiley & Sons, Chichester. 5. Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996
Reference Books	<ol style="list-style-type: none"> 1. Kulkarni, V. and Ramachandra, T.V. 2006. Environmental Management, Capital Pub. Co. New Delhi. 2. Petts, J. 2005. Handbook of Environmental Impact Assessment- Volume 1 and 2. Blackwell Publishers, UK. 3. Glasson, J. Therivel, R. and Chadwick. 2006. A. Introduction to Environmental Impact Assessment. Routledge, London. 4. Canter, W.L. 1995. Environmental Impact Assessment, McGraw-Hill Science/ Engineering/ Math, New York. 5. Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
Web resources	<ol style="list-style-type: none"> 1. https://www.amazon.in/Environmental-Impact-Assessment-Gajbhiye-Khandeshwar-ebook/dp/B06XTNQ5PW 2. https://www.ikbooks.com/books/book/earth-environmental-sciences/environmental-impact-assessment/9789382332930/ 3. https://www.elsevier.com/books/environmental-impact-assessment/mareddy/978-0-12-811139-0 4. https://link.springer.com/book/10.1007/978-3-030-80942-3 5. https://onlinelibrary.wiley.com/doi/book/10.1002/0471722022

Mapping with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	3	2	1	2	2	2	2
CO 2	3	3	2	2	3	3	2	3	2	3
CO 3	2	2	1	3	1	1	2	3	2	3
CO 4	3	3	3	3	2	2	3	3	3	3
CO 5	3	2	2	3	1	3	3	3	3	3

S-Strong (3)

M-Medium (2)

L-Low(1)