



DEPARTMENT OF BOTANY

Syllabus of
**Bachelor's Degree in
Science (BOTANY)**

**CHOICE BASED CREDIT SYSTEM
SEMESTER SCHEME
UNDER NEW EDUCATION POLICY 2020
2021-22 ONWARDS**

**Approved by the BOS meeting held on 12th November 2021
Approved by the Academic Council meeting, held on 10-12-2021**



DISCIPLINE SPECIFIC CORE - BOTANY

Preamble

The present situation necessitates transformation and/or redesigning of the system, not only by introducing innovations but developing a “learner-centric” approach. Thus, there is a need to allow flexibility in the education system, so that students depending upon their interests can choose interdisciplinary, intra-disciplinary and skill-based courses. It is also to bridge the increasing gap between an undergraduate degree and employability.

Karnataka State Higher Education Council has proposed a model curriculum framework and an implementation plan for the State of Karnataka. Based on these recommendations, Mangalore University issued guidelines to its affiliated and autonomous colleges to implement the National Education Policy from the academic year 2021-2022. Hence, our college thought to implement multidisciplinary and holistic education in all the undergraduate programs with multiple entries and exit options with multiple certificate/diploma/degrees to replace the present undergraduate degree programs effective from the academic year 2021-2022.

The Department of Botany proposed a Four-year, Undergraduate Curriculum in Botany to cater to the needs of students with diverse talents, aspirations and professional requirements. Students will have the option to exit after one year with the certificate, two years with an award of the diploma and after three years with the award of the bachelor's degree. Successful completion of 4- year program will lead to the award of a bachelor degree with honours.

The salient features of the curriculum are as follows

Discipline Core Course (DCC)

Discipline Elective course (DEC)

Discipline Open Elective (DOE)



Program Outcomes in First year (Adopted from the Model curriculum):

- PO1: Skill development for the proper description using botanical terms, identification, naming, and classification of life forms especially plants and microbes.
- PO2: Acquisition of knowledge on the structure, life cycle, and life processes that exist among plant and microbial diversity through certain model organism studies.
- PO3: Understanding various interactions between plants and microbes; to develop the curiosity about the dynamicity of nature.
- PO6: Skill development for the collection, preservation, and recording of information after observation and analysis- from simple illustration to molecular database development.
- PO8: Internalization of the concept of conservation and evolution through the channel of the spirit of inquiry.
- PO 9: To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC, etc.
- PO 12: The graduate should be able to demonstrate sufficient proficiency in the hands-on experimental techniques for their area of specialization within biology during research and their professional career.

Botany Course Outcomes (Cos):

Semester I (A-1): Microbial Diversity and Technology

1. Understand the fascinating diversity, evolution, and significance of microorganisms.
2. Comprehend the systematic position, structure, physiology, and life cycles of microbes and their impact on humans and the environment.
3. Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

Semester II (A-2): Diversity of Non- Flowering Plants

1. Understand the diversity and affinities among Algae, Bryophytes, Pteridophytes, and Gymnosperms.
2. Understand the morphology, anatomy, reproduction, and life cycle across Algae, Bryophytes, Pteridophytes, and Gymnosperms, and their ecological and evolutionary significance.
3. Obtain laboratory skills/explore non-flowering plants for their commercial applications.



COURSE DESCRIPTION

SI. No	Paper code	Title of the Paper	Credits	Marks		
				IA	Sem End	Total
I Semester B.Sc.						
1	DSC-1	Microbial Diversity and Technology	4	40	60	100
2	DSC Lab-1	Microbial Diversity and Technology	2	25	25	50
3	OE-1A Or OE-1B	Plants and Human Welfare Or Ethnobotany	3	40	60	100
II Semester B.Sc.						
4	DSC-2	Diversity of Non-Flowering Plants	4	40	60	100
5	DSC Lab-2	Diversity of Non-Flowering Plants	2	25	25	50
6	OE-2A or OE-2B	Plant Propagation, Nursery management and Gardening or Mushroom Culture Technology	3	40	60	100
III Semester B.Sc.						
7	DSC-3	Plant Anatomy and Development Biology	4	40	60	100
8	DSC Lab-3	Plant Anatomy and Development Biology Practicals	2	25	25	50
9	OE-3		3	40	60	100



IV Semester B.Sc.						
10	DSC-4	Ecology & Conservation Biology	4	40	60	100
11	DSC Lab-4	Ecology & Conservation Biology Practicals	2	25	25	50
12	OE-4		3	40	60	100
V Semester B.Sc.						
13	DSC-5		3	40	60	100
14	DSC Lab-5		2	25	25	50
15	DSC-6		3	40	60	100
16	DSC Lab-6		2	25	25	50
17	DSE-1		3	40	60	100
VI Semester B.Sc.						
18	DSC-7		3	40	60	100
19	DSC Lab-7		2	25	25	50
20	DSC-8		3	40	60	100
21	DSC Lab-8		2	25	25	50
22	DSE-2		3	40	60	100
VII Semester B.Sc.						
23	DSC-9		3	40	60	100
24	DSC Lab-9		2	25	25	50
25	DSC-10		3	40	60	100
26	DSC Lab-10		2	25	25	50
27	DSC-11		3	40	60	100
28	DSE-3		3	40	60	100
29	Research Methodology (RM)		3	40	60	100
VIII Semester B.Sc.						
30	DSC-12		3	40	60	100
31	DSC-13		3	40	60	100
32	DSC-14		3	40	60	100
33	DSE-4		3	40	60	100
34	Project		6			

Note: Open Elective(OE) offered to non Botany students



COURSE PATTERN AND SCHEME OF EXAMINATION

I Semester									
Paper Code	Title of the Paper	Pedagogy	Assessment	Instruction Hours	Duration of Examination (Hrs)	Max. Marks			Credits
						Exam	IA	Total	
DSC-1	Microbial diversity & technology	Lectures, Interaction, Assignment, Participative learning Seminars, Group Discussions	Internal Exams, Quiz, Assignment and Sem End Examination	4	2	60	40	100	4
DSC Lab-1	Microbial diversity & technology Practicals	Practicals Laboratory/ Field Visits	Internal Exam, Continuous evaluation and Sem End Examination	4	3	25	25	50	2
OE-1	Plants and Human Welfare (For Non-Botany students)	Lectures, Interaction, Assignment, Participative learning Seminars, Group Discussions	Internal Exams, Quiz, Assignment and Sem End Examination	3	2	60	40	100	3
Total number of credits for the subjects in I Semester:09									
II Semester									
DSC-2	Diversity of Non-Flowering Plants	Lectures, Interaction, Assignment, Participative learning Seminars, Group Discussions	Internal Exams, Quiz, Assignment and Sem End Examination	4	2	60	40	100	4
DSC Lab -2	Diversity of Non-Flowering Plants Practicals	Practicals Laboratory/ Field Visits	Internal Exam, Continuous evaluation and Sem End Examination	4	2	25	25	50	2
OE-2	Plant Propagation, Nursery manageme	Lectures, Interaction, Assignment, Participative	Internal Exams, Quiz, Assignment	3	2	60	40	100	3



	nt and Gardening	learning Seminars, Group Discussions	and Sem End Examination					
Total number of credits for the subjects in II Semester: 09								



B.Sc. BOTANY: Semester - 1**Title of the Course: Microbial Diversity and Technology**

Number of Theory Credits :4

Number of lecture hours/semester :56

Number of practical Credits :2

Number of practical hours / semester :56

Unit I**15 Hours****Chapter No. 1:****05 Hours**

Microbial diversity-Introduction to microbial diversity; Hierarchical organization and positions of microbes in the living world: Whittaker's five-kingdom system and Carl Richard Woese's three-domain system. Distribution of microbes in the soil, air, food, and water. Significance of microbial diversity in nature.

Chapter No. 2**05 Hours**

History and developments of microbiology-Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky, and M W Beijerinck and Paul Ehrlich).

Chapter No. 3**05 Hours**

Microscopy-Working principle and applications of light, darkfield, phase contrast, and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic, and special) and Principles of staining. Simple, Gram and differential staining.

Self Study Components:

An account on Indian microbiologists

Unit II**15 Hours****Chapter No. 4.****05 Hours**

Culture media for Microbes-Natural and synthetic media, Routine media -basal media, enriched media, selective media, indicator media, transport media, and storage media.

Chapter No. 5.**05 Hours**

Sterilization methods -Methods of disinfection: antiseptic, tyndallization, and Pasteurization. Sterilization-Physical methods: dry heat, moist heat, UV light, ionization radiation, filtration. Chemical methods - phenolic compounds, anionic and cationic detergents.



Chapter No. 6.

05 Hours

Microbial Growth-Microbial growth and measurement. Nutritional types of Microbes- autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.

Unit III

11 Hours

Chapter No. 7.

05 Hours

Microbial cultures and preservation-Microbial cultures. Pure culture and axenic cultures, subculturing. Preservation methods-overlaying cultures with mineral oils, lyophilization. Microbial culture collections and their importance. A brief account of ITCC, MTCC, and ATCC.

Chapter No. 8.

02 Hours

Viruses- General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, and Bacteriophage (T2). Cultivation of viruses. Vaccines and types.

Self Study Components:

An account on Viral plant diseases (Disease, Causative virus, Host plant and Important symptoms)

Chapter No. 9.

04 Hours

Viroids- general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases. Economic importance of viruses.

Unit IV

15 Hours

Chapter No. 10.

05 Hours

Bacteria- General characteristics and classification.(Bergey's classification) Archaeobacteria and Eubacteria. Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of Rhizobium and its applications. A brief account of Actinomycetes. Mycoplasmas and Phytoplasmas- General characteristics and diseases.

Chapter No. 11.

07 Hours

Fungi-General characteristics and classification (Alexopoulos classification). Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study: Morphology of Phytophthora, Rhizopus, Neurospora, Puccinia,



Penicillium, and Trichoderma. Morphology and reproduction of Phytophthora and Puccinia. VAM Fungi and their significance.

Microbial plant diseases-Late Blight of Potato, Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus canker

Chapter No. 12.

03 Hours

Lichens –Types, Structure and reproduction. Economic importance

Self Study Components:

An Account of Edible Mushrooms

Text Books

1. Ananthanarayan R and Panikar JCK. 1986. Textbook of Microbiology. Orient Longman Ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, NewDelhi.
3. William CG. 1989. Understanding microbes. A laboratory textbook for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, NewDelhi.
5. Dubey RC and Maheshwari DK. 2002. A Textbook of Microbiology, S.C.Chand, and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Textbook of Microbiology. Mittal Publications. New Delhi. 305pp.
7. Sharma PD. 1999. Microbiology and Plant Pathology. Rastogi publications. Meerut, India.
8. Vasanthkumari R. 2007. A textbook of Microbiology, BI Publications Pvt. Ltd., New Delhi.



References

1. Alexopoulos CJ and Mims CW. 1989. Introductory Mycology, Wiley Eastern Ltd., New Delhi.
2. Allas RM. 1988. Microbiology: Fundamentals and Applications, Macmillan publishing co. New York.
3. Brook TD, Smith DW and Madigan MT. 1984. Biology of Microorganisms, 4th ed. Eaglewood Cliffs. N.J. Prentice-Hall. New Delhi.
4. Burnell JH and Trinci APJ. 1979. Fungal walls and hyphal growth, Cambridge University Press. Cambridge.
5. Jayaraman J. 1985. Laboratory Manual of Biochemistry, Wiley Eastern Limited. New Delhi.
6. Ketchum PA. 1988. Microbiology, concepts, and applications. John Wiley and Sons. New York.
7. Michel J, Pelczar Jr. EC and Krieg CR. 2005. Microbiology, Mc.Graw-Hill, New Delhi.
8. Powar CB and Dagainawala. 1991. General Microbiology, Vol – I and Vol – II Himalaya publishing house, Bombay.
9. Reddy S and Ram. 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385pp.
10. Sullia SB and Shantharam S. 1998. General Microbiology. Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
11. Schlegel HG. 1986. General Microbiology. Cambridge. University Press. London, 587pp.
12. Roger S, Ingraham Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World 5th edition. Prentice-Hall India, Pvt. Ltd. New Delhi.
13. Sullia SB. and Shantharam S. 2005. General Microbiology, Oxford and IBH, New Delhi.



Content of Practical Course 1: List of Experiments to be conducted

Practical 1: Safety measures in microbiology laboratory and study of equipment/appliances used for microbiological studies (Microscopes, Hot air oven, Autoclave/Pressure Cooker, Inoculation needles/loop, Petri plates, Incubator, Laminar flow hood, Colony counter, Haemocytometer, Micrometer.

Practical 2: Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of E coli / B. subtilis/ Fungi and study of cultural characteristics.

Practical 3: Enumeration of soil/food /seed microorganisms by serial dilution technique.

Practical 4: Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.

Practical 5: Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.

Practical 6: Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.

Practical 7: Isolation and study of morphology of Rhizobium from root nodules of legumes

Practical 8: Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.

Practical 9: Study of vegetative structures and reproductive structures of any six of the following: Albugo, Phytophthora, Rhizopus/Mucor, Saccharomyces, Neurospora/ Sordaria, Puccinia, Agaricus, Lycoperdon, Aspergillus/Penicillium, Trichoderma. (Depending on local availability)

Practical 10: Study of late blight of Potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, Sandal spike disease.

Practical 11: Study of well-known microbiologists and their contributions through charts and photographs.

Practical-12: Visit to water purification units/Composting/ microbiology labs/dairy and farms to understand the role of microbes in day today life. Field study report is to be documented in the practical record only

(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of the study report is compulsory)



Scheme of Formative Assessment: Semester - 1**Pedagogy:**

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission, etc

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
I TEST	10
II TEST	10
ASSIGNMENT	10
SEMINAR	10
Total	40



B.Sc. BOTANY: Open Elective Course (OE-1)

I Semester

Title of the Course: Plants and Human Welfare

Course Outcome:

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

1. To make the students familiar with the economic importance of diverse plants that offer resources to human life.
2. To make the students know about the plants used as food, medicinal value, and also plant sources of different economic value.
3. To generate interest amongst the students on plants' importance in day-to-day life, conservation, ecosystem, and sustainability.

Number of Theory Credits : 3

Number of lecture hours/semester : 42

Number of practical Credits : 0

Number of practical hours / semester : 0

Unit I

02 Hours

Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant biodiversity and conservation.

Unit II

03 Hours

Cereals: Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses). Green revolution. A brief account of millets and their nutritional importance.

Unit III

02 Hours

Legumes: General account (including chief pulses grown in Karnataka- red gram, green gram, chickpea, soybean). Importance to man and ecosystem.

Unit IV

02 Hours

Fruits: Mango, grapes, and Citrus (Origin, morphology, cultivation, processing, and uses)

Unit V

03 Hours

Cash crops: Morphology, new varieties, and processing of sugarcane, products, and by-products of



the sugarcane industry. Natural Rubber –cultivation, tapping, and processing.

Unit VI **03 Hours**

Spices: Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper, and cardamom.

Unit VII **02 Hours**

Beverages: Tea, Coffee(morphology, processing & uses)

Unit VIII **02 Hours**

Oils and fats: General description, classification, extraction, their uses, and health implications; groundnut, coconut, sunflower and mustard (Botanical name, family & uses). Non-edible oil yielding trees and importance as biofuel. Neem oil and applications.

Unit IX **02 Hours**

Essential Oils: General account. Extraction methods of sandalwood oil, rosa oil, and eucalyptus oil. Economic importance as medicine, perfumes, and insect repellents.

Unit X **03 Hours**

Drug-yielding plants: Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Aloe vera, and Cannabis

Unit XI **03 Hours**

Fibers: Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses).

Unit XII **03 Hours**

Forests: Forest and forest products. Community forestry. Concepts of reserve forests, sanctuaries, and national parks with reference to India. Endangered species and red data book.

Text Books and References

1. Kochhar, S.L. (2012). Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
2. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
3. Chrispeels, M.J., and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett - Publishers.



B.Sc. BOTANY: Open Elective Course (OE-1)

I Semester

Title of the Course: Ethnobotany

Number of Theory Credits :3

Number of lecture hours/semester :42

Number of practical Credits :0

Number of practical hours / semester :0

Unit 1: Ethnobotany

10 Hours

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

Unit 2: Methodology of Ethnobotanical studies

10 Hours

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

Unit 3: Role of ethnobotany in modern Medicine

12 Hours

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



serpentina, Trichopus zeylanicus, Artemisia, Withania. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).

Unit 4: Ethnobotany and legal aspects

10 Hours

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

Suggested Readings

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
- 3) Colton C.M. 1997. Ethnobotany :Principles and applications. John Wiley and sons –Chichester
- 4) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996)

**Scheme of Formative Assessment : (OE-1)
Semester - 1**

Pedagogy:

Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission, etc

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
I TEST	10
II TEST	10
ASSIGNMENT	10
SEMINAR	10
Total	40



B.Sc. BOTANY: Semester - 2

Title of the Course: Diversity of Non- Flowering Plants

Number of Theory Credits :4

Number of lecture hours/semester :56

Number of Practical Credits :2

Number of practical hours / semester :56

Unit I

15 Hours

Chapter No. 1

05 Hours

Algae –Introduction and historical development in algology. Distribution of Algae. General characteristics, classification of algae by Fritsch. Diversity- habitat, thallus organization, pigments, reserve food, flagella types, life cycle, and alternation of generation in Algae.

Chapter No. 2

05 Hours

Morphology and reproduction and life-cycles of Nostoc, Scytonema, Oedogonium, Chara, Sargassum, and Polysiphonia/*Batrachospermum* . Diatoms and their importance.

Chapter No. 3

05 Hours

Algal cultivation- a general account. Cultivation of microalgae Spirulina and Dunaliella; Algal products- Food and Nutraceuticals, Feedstocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibers from algae. Algal blooms and toxins.

Self learning components:

Phylogenetic classification system of Algae.

Unit II

15 Hours

Chapter No. 4.

03 Hours

Bryophytes – General characteristics and classification (Rothmaler) of Bryophytes.

Chapter No. 5.

07 Hours

Distribution, morphology, anatomy, reproduction, and life cycles of Riccia, Anthoceros, and Funaria. Ecological and economic importance of Bryophytes.

Chapter No. 6.

05 Hours

Pteridophytes- General characteristics and classification (Smith); Distribution, morphology, anatomy, reproduction, and life-cycle in Selaginella, Equisetum, Pteris, and Marselia.



Unit III

15 Hours

Chapter No. 7.

05 Hours

A brief account of heterospory and seed habit. Stellar evolution in Pteridophytes. Affinities and evolutionary significance of Pteridophytes. Ecological and economic importance.

Chapter No. 8.

05 Hours

Gymnosperms- General characteristics. Distribution and classification of Gymnosperms (Sporne). Study of the habitat, habit, anatomy, reproduction, and life-cycle in Cycas, Pinus, and Gnetum.

Chapter No. 9.

05 Hours

Affinities and evolutionary significance of Gymnosperms. Economic importance of Gymnosperms - food, timber, industrial uses, and medicines.

Unit IV

11 Hours

Chapter No. 10.

02 Hours

Origin and evolution of Plants: Origin and evolution of plants through Geological Time scale.

Chapter No. 11.

05 Hours

Paleobotany- Paleobotanical records, plant fossils, Types of plant fossils - impressions, compressions, incrustation, actual remains petrification. Radiocarbon dating. A general account of fossil Bryophytes.

Chapter No. 12.

03 Hours

Fossil taxa- Rhynia, Lepidodendron, Cycadeoidea. Contributions of Birbal Sahni. Birbal Sahni Institute of Palaeosciences.

Self Study Component:

Fossil taxa- Rhynia, Lepidodendron, Cycadeoidea.

Text Books

- 1) Chopra, G.L. A textbook of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
- 2) Johri, Lata and Tyagi, 2012, A Text Book of, Vedam eBooks, New Delhi.
- 3) Sharma, O.P. 1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
- 4) Sharma, O.P. 1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.



5) Sharma, O.P., 2017, Algae Singh-Pande-Jain 2004-05. A Text-Book of Botany. Rastogi Publication, Meerut.

References

1. Sambamurty, A.V.S.S. A Text-Book of Algae. I.K. International Private Ltd., New Delhi.
2. Agashe, S.N. 1995. Paleobotany. Plants of the past, their evolution, paleoenvironment, and Allied plants. Hutchinson & Co., Ltd., London.
3. Anderson R.A. 2005, Algal cultural Techniques, Elsevier, London.
4. Publication, Application in the exploration of fossil fuels. Oxford & IBH., New Delhi.
5. Eams, A.J., (1974) Morphology of vascular plants - Lower groups. Tata Mc Grew Hill Publishing Co. New Delhi, Freeman & Co., New York.
6. Fritze, R.E. 1977. Structure and reproduction of Algae. Cambridge University Press.
7. Goffinet B and Shaw A.J. 2009, Bryophyte Biology, 2nd ed. Cambridge University Press, Cambridge. Gymnosperms.
8. Srivastava, H N, 2003. Algae Pradeep Publication, Jalandhar, India. 9. Kakkar, R.K. and B.R.Kakkar (1995) The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
9. 10. Kumar H. D., 1999, Introductory Phycology, Affiliated East-West Press, Delhi. 11. Lee, R.E., 2008, Phycology, Cambridge University Press, Cambridge. 4th edition. McGraw Hill Publishing Co., New Delhi.
10. Parihar, N.S. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
11. Parihar, N.S. (1976) An Introduction to Pteridophytes, Central Book Depot, Allahabad.
12. Parihar, N.S. 1977. The Morphology of Pteridophytes. Central Book Depot., Allahabad. Press, Cambridge.
13. Rashid, A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
14. Smith, G.M. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata Tata McGraw Hill Publishing, New Delhi.
15. Smith, G.M. 1971. Cryptogamic Botany. Vol. I Algae & Fungi. Tata McGraw Hill Publishing. New Delhi.
16. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.



17. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants, Cambridge University Cambridge.
12. Sundarajan, S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi. 21.
- Vanderpoorten, A. and Goffinet, B. 2009, Introduction to Bryophytes, Cambridge University Press, Cambridge.
22. Vashista, B.R. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

Pedagogy: Lectures, Practicals, Field and laboratory visits, participatory learning, seminars, assignments, MOOCs, and specimen preparation, and submission.

Content of Practical Course 2: List of Experiments to be conducted

Practical-1: Study of morphology, classification, reproduction, and life cycle of Nostoc/Anabaena/Oscillatoria.

Practical-2: Study of morphology, classification, reproduction, and life-cycle of Oedogonium & Chara, Sargassum, Batrachospermum/ Polysiphonia.

Practical-3: Study of morphology, classification, reproduction, and life-cycle of Marchantia/Riccia & Anthoceros.

Practical-4: Study of morphology, classification, anatomy, reproduction, and life-cycle of Selaginella and Equisetum.

Practical -5: Study of morphology, classification, anatomy, reproduction and life-cycle of Pteris, Azolla/Salvinia.

Practical -6: Study of morphology, classification, anatomy and reproduction in Cycas.

Practical -7: Study of morphology, classification & anatomy, reproduction in Pinus.

Practical -8: Study of morphology, classification & anatomy, reproduction in Gnetum.

Practical -9: Study of important blue-green algae causing water blooms in the lakes.

Practical -10: Study of different methods of cultivation of ferns in a nursery.

Practical -11: Preparation of natural media and cultivation of Azolla in artificial ponds.

Practical -12: Media preparation and cultivation of Spirulina.

Practical -13: Study different algal products and fossils impressions and slides.

Practical-14: Visit algal cultivation units/lakes with algal blooms/Fern house/ Nurseries/Geology museum/lab to study plant fossils.

(Note: Botanical study tour to a floristic rich area for 1-2 days and submission of the study report is compulsory)



Scheme of Formative Assessment: Semester - 2

Pedagogy: Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission, etc

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
I TEST	10
II TEST	10
ASSIGNMENT	10
SEMINAR	10
Total	40



B.Sc. BOTANY: Open Elective Course (OE-1)

II Semester

Title of the Course: Plant Propagation, Nursery management, and Gardening

Course Outcome:

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

1. To gain knowledge of gardening, cultivation, multiplication, raising of seedlings of garden plants.
2. To get knowledge of new and modern techniques of plant propagation.
3. To develop an interest in nature and plant life.

Number of Theory Credits :3

Number of lecture hours/semester : 42

Number of practical Credits :0

Number of practical hours / semester :0

Unit I

04 Hours

Nursery: Definition, objectives and scope and general practices and building up of infrastructure for nursery, planning and seasonal activities. Planting - direct seeding and transplants, Soil free/soilless/ synthetic growth mediums for pots and nursery.

Unit II

06 Hours

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

Unit III

06 Hours

Vegetative propagation: Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium, and planting of cuttings. Hardening of plants . Greenhouse, mist chamber, shedroof, shade house, and glasshouse.

Unit IV

08 Hours

Gardening: Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design. Computer applications in landscaping, Gardening operations: soil laying, manuring, watering, management of



pests and diseases and harvesting.

Unit V

06 Hours

Sowing/raising of seeds and seedlings - Transplanting of seedlings - Study of cultivation of different vegetables and flowering plants: cabbage, brinjal, lady's finger, tomatoes, carrots, bougainvillea, roses, geranium, ferns, petunia, orchids etc. Storage and marketing procedures. Developing and maintenance of different types of lawns. Bonsai technique.

Text Books and References

1. Agrawal, P.K. (1993). HandBook of Seed Technology. New Delhi, Delhi: Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.
2. Bose T.K., Mukherjee, D. (1972). Gardening in India. New Delhi, Delhi: Oxford & IBH Publishing Co.
3. Jules, J. (1979). Horticultural Science, 3rd edition. San Francisco, California: W.H. Freeman and Co.
4. Kumar, N. (1997). Introduction to Horticulture. Nagercoil, Tamil Nadu: Rajalakshmi Publications.

Additional Resources:

1. Musser E., Andres. (2005). Fundamentals of Horticulture. New Delhi, Delhi: McGraw Hill Book Co.
2. Sandhu, M.K. (1989). Plant Propagation. Madras, Bangalore: Wile Eastern Ltd.



B.Sc. BOTANY: Open Elective Course (OE-2)
II Semester
Title of the Course: Mushroom Culture Technology

Number of Theory Credits :3

Number of lecture hours/semester :42

Number of practical Credits :0

Number of practical hours / semester :0

Unit 1

8 Hours

Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - Volvariella volvacea, Pleurotus citrinopileatus, Agaricus bisporus.

Unit 2

14 Hours

Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

Unit 3

12 Hours

Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit 4

8 Hours

Food Preparation: Types of foods prepared from mushrooms. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

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



Scheme of Formative Assessment : (OE-2)Semester - 2

Pedagogy: Lectures, Practicals, Field and laboratory visits, Participatory Learning, Seminars, Assignments, specimen submission, etc

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
I TEST	10
II TEST	10
ASSIGNMENT	10
SEMINAR	10
Total	40

AECC-1: ENVIRONMENTAL STUDIES**Ability Enhancement Compulsory Course (AECC) Course Objectives:**

1. To make students realize the importance and their role in the protection and maintenance of a healthy environment for sustainable development.
2. To enable students to grasp the significance and issues related to ecosystems, biodiversity and natural resources, and ways of managing/ protecting them.
3. To enable students to have a nuanced understanding of environmental pollution, solid waste management and climate change and to act with concern on environmental issues.
4. To make students aware of the environmental policies and movements, and the role of individuals and communities in environmental protection for educating and inspiring young minds. Learning Outcomes:

At the end of the course, students will –

1. Understand the importance and dimension of a healthy environment, become environmentally conscious, skilled and responsible in all their actions with a concern for sustainable development.
2. Comprehend the significance and issues related to ecosystems, natural resources and biodiversity and become aware of the need and ways to protect/ preserve them.



3. Grasp the issues related to environmental pollution, solid waste management and climate change, and become conscious and proactive in the discharge of their responsibilities towards the environment.
4. Become aware and appreciate the values and concerns of environmental movements and policies and the role of communities, and act responsibly on environment-related issues.

Pedagogy: Lectures/Tutorials/Interactive Sessions/Open Educational Resources (as reference materials), practical exercises/Assignments/ Seminars/Group discussions and Counselling.



Course Title: ENVIRONMENTAL STUDIES

Course Code: AECC-1

Course Credits: 2

No. of Teaching Hours/Week: 2 Duration

of End Sem. Exam: 3 Hours

Total Contact Hours: 28 Assessment

(Marks): 60 (Theory) + 40 (IA) =100

AECC-1: ENVIRONMENTAL STUDIES

UNIT 1: Introduction

7 hours

Environmental Studies – Importance and scope, multidisciplinary nature; Concept of sustainability and sustainable development

Ecosystems –Concept, structure and function; Pond ecosystem, Forest ecosystem; Food chains, Food webs; Concept of ecological succession

Bio-geographical zones of India; Levels of biological diversity- Genetic, Species and ecosystem; Biodiversity Hotspots with special reference to India; Threats to biodiversity

Conservation of biodiversity: In-situ and Ex-situ; Endangered and endemic species – Concept; Afforestation – Social forestry, Agroforestry, Green belt

UNIT 2: Environmental pollution and its management

7 hours

Air pollution, water pollution, noise pollution, - Causes, effects and control measures.

Climate change, global warming, ozone layer depletion, acid rain and its impact on human communities and agriculture

Solid waste management - biodegradable and non-biodegradable waste; Segregation of domestic waste at source

Impact of plastic on human and animal health

UNIT 3: Natural resources and management

7 hours

Land resources and land-use changes; Land degradation, soil erosion and desertification

Water: Use and over-exploitation of surface and groundwater; Water conservation - rainwater harvesting; Watershed management – Meaning and importance

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources

Disaster management– Definition and types (Natural and Man-made); Self-protection during disasters (Fire, Floods, Earthquakes, landslides)



UNIT 4: Environmental Policies and Practices

7 hours 4.1:

Human population growth: Impact on environment, human health and welfare;
Environmentalethics– Role of religion and cultures
Environment movements – Chipko, Narmada Bachao Andolan, Silent valley,
Bishnois ofRajasthan
Individual and community initiatives – Salu Marada Thimmakka; Concept of Sacred
Groves(Devarakadu)
Environment Protection Act; Biodiversity Act (2002); National Environmental Policy,
2006 – Provisions and importance; Environmental Impact Assessment – Concept;
Swachh Bharat Mission– Objectives; International agreements – Montreal and Kyoto
protocols

Textbooks & References

1. Agarwal, K.C. (2001) Environmental Biology, Bikaner, Nidhi Pub.
2. Basker, Sushmitha & Bhasker, R. (2007) Environmental Studies for Undergraduate Courses, New Delhi, Unicorn Books.
3. Bharucha, Erach, (2013) Textbook of Environmental Science. Orient Black Swan.
4. Bhatt, K. N. (2010) Population Environment and Health – emerging issues, Jaipur, Rawat.
5. Carson, R. (2002) Silent Spring. Houghton Mifflin Harcourt.
6. Coenraads, Robert (2010) Natural disasters and how we cope Millennium House.
7. Hebbar, Aravinda, (2003) Parisara Vijnana, Udupi, Lathangi Prakashana.
8. Gadgil, M., & Guha, R. (1993). This Fissured Land: An Ecological History of India, Univ. of California Press.
9. Gleeson, B. and Low, N. (eds.) (1999). Global Ethics and Environment, London, Routledge.
10. Glejck, P. H. (1993). Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, OUP.
11. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. (2006). Principles of Conservation Biology. Sunderland: Sinauer Associates.
12. McCully, P. (1996). Rivers no more: the environmental effects of dams (pp. 29-64) Zed



Books.

13. McNeill, John R. (2000). Something New Under the Sun: An environmental history of the Twentieth Century.
14. Nandini, N. (2019). A textbook on Environmental Studies (AECC). Sapna BookHouse, Bengaluru.
15. Grumbine, R. Edward, and Pandit, M.K. (2013). Threats from India's Himalayadams. Science, 339: 36-37.
16. Odum, E. P. (1983) Basic Ecology, Saunders.
17. Odum, E.P., Odum, H.T. & Andrews, J. (1971). Fundamentals of Ecology, Philadelphia:Saunders.
18. Pandey, G.N. (1997) Environmental Management. Vikas Publishing House.
19. Roy, Pashupati Kumar and Kumar, Arvind (2008) Environmental Resource Management. DayaPub.
20. Pepper, I.L, Gerba, C.P. & Brusseau, M.L. (2011). Environmental and Pollution Science. Academic Press.
21. Rao, M.N. & Datta, A.K. (1987). Waste Water Treatment. Oxford and IBH Pub.
22. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. (2012). Environment. 8th edition. John Wiley & Sons.
23. Rosencranz, A., Divan, S., & Noble, M. L. (2001). Environmental law and policy in India. Tripathi 1992.
24. Sengupta, R. (2003). Ecology and economics: An approach to sustainable development OUP.
25. Sharma, P.D. (2011) Ecology and Environment, Rastogi Publications.
26. Singh, Harimohan (2010) Waste Water Treatment Technology, Alfa Publications, New Delhi,
27. Singh, Janamjit (2006) Biodiversity - planning for sustainable development, New Delhi, Deepand Deep Pub.
28. Singh, R.B. and Mal, Suraj (2009) Environmental change and bio-diversity. Jaipur, Rawat,
29. Singh, J.S., Singh, S.P. and Gupta, S.R. (2014). Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.



30. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). (2013). Conservation Biology: Voices from the Tropics. John Wiley & Sons.
31. Thapar, V. (1998) Land of the Tiger: A Natural History of the Indian Subcontinent, Warren, C.
E. (1971). Biology and Water Pollution Control. WB Saunders.
32. Wilson, E. O. (2006). The Creation: An appeal to save life on earth. New York: Norton.
33. World Commission on Environment and Development. (1987). Our common future. Oxford University Press.



Discipline Core Course-Botany Question Paper Pattern

Sri Dharmastala Manjunatheshwara College(Autonomous) Ujire

Duration: 2 Hours

Marks: 60

Part A

1. Answer any 10 of the following

10X2= 20 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

Part B

- | | | |
|---|----|---|
| 2 | a. | 3 |
| | b. | 3 |
| | c. | 4 |

OR

- | | | |
|----|----|---|
| 3. | a. | 3 |
| | b. | 3 |
| | c. | 4 |

- | | | |
|----|----|---|
| 4. | a. | 3 |
| | b. | 3 |
| | c. | 4 |

OR

- | | | |
|----|----|---|
| 5. | a. | 3 |
|----|----|---|



- b. 3
c. 4
6. a. 3
b. 3
c. 4
7. **OR**
- a. 3
b. 3
c. 4
8. a. 3
b. 3
c. 4
9. **OR**
- a. 3
b. 3
c. 4



Discipline Open Elective Course-Botany Question Paper Pattern
Sri Dharmastala Manjunatheshwara College(Autonomous) Ujire

Duration: 2 Hours

Marks: 60

Part A

1. Answer any 10 of the following

10X2= 20 Marks

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.
- 11.
- 12.

Part B

- | | | |
|---|----|---|
| 2 | a. | 3 |
| | b. | 3 |
| | c. | 4 |

OR

- | | | |
|----|----|---|
| 3. | a. | 3 |
| | b. | 3 |



4. c. 4
- a. 3
- b. 3
- c. 4
- OR**
5. a. 3
- b. 3
- c. 4
6. a. 3
- b. 3
- c. 4
- OR**
7. a. 3
- b. 3
- c. 4
8. a. 3
- b. 3
- c. 4
- OR**
9. a. 3
- b. 3
- c. 4

SCHEME OF EXAMINATION AND EVALUATION
ASSESSMENT IN PERCENTAGE

Type of Course	Formative /IA	Summative/Term end
Theory	40	60
Practicals	50	50

