



**NATIONAL EDUCATION
POLICY-2020
(NEP-2020)**

*Approved
through
online consultation*

*18/03/2025
Chairman - UG - BOS*

BOTANY SYLLABUS

of 1st to 4th Semester

Submitted

to

Davangere University

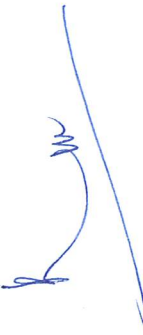
Davangere-577 007

Department of Studies in Botany

Davangere University

Discipline Core Paper Structure (DSC)

Sem	Course Category	Course Code	Course Title	Credits Assigned	Instructional Hours per week		Duration of the exam	Exam/ Evaluation pattern (Marks)		
					Theory	Practical		IA	Exam	Total
I	DSC	BOTC1-T	Microbial Diversity and Technology	4	4		2	40	60	100
		BOTC2-P	Microbial Diversity and Technology	2		4	3	25	25	50
II	DSC	BOTC3-T	Diversity of Non-flowering plants	4	4		2	40	60	100
		BOTC4-P	Diversity of Non-flowering plants	2		4	3	25	25	50
III	DSC	BOTC5-T	Plant Anatomy and Development Biology	4	4		2	40	60	100
		BOTC6-P	Plant Anatomy and Development Biology	2		4	3	25	25	50
IV	DSC	BOTC7-T	Ecology and Conservation Biology	4	4		2	40	60	100
		BOTC8-P	Ecology and Conservation Biology	2		4	3	25	25	50



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Open Elective Course Structure (OEC)

Semester	Subject	Course Code	Paper No.	Credits	Theory	Internal	Total
I	Plant and Human Welfare	BOTOE1.1	O-1	3	60	40	100
	Botany for the Beginners	BOTOE1.2	O-2	3	60	40	100
	Mushroom Cultivation	BOTOE1.3	O-3	3	60	40	100
II	Plant Propagation, Nursery Management and Gardening	BOTOE2.1	O-4	3	60	40	100
	Biofuels	BOTOE2.2	O-5	3	60	40	100
	Biofertilizers	BOTOE2.3	O-6	3	60	40	100
III	Community Forestry	BOTOE3.1	O-7	3	60	40	100
	Algal Cultivation and Applications	BOTOE3.2	O-8	3	60	40	100
	Landscaping and Gardening	BOTOE3.3	O-9	3	60	40	100
IV	Plant Diversity and Human Welfare	BOTOE4.1	O-10	3	60	40	100
	Medicinal Plants in Health Care	BOTOE4.2	O-11	3	60	40	100
	Floriculture	BOTOE4.3	O-12	3	60	40	100


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PROGRAMME SPECIFIC OUTCOME OF B.Sc. BOTANY PROGRAMME

PSO1: Skill development for the proper description using botanical terms, identification, naming and classification of life forms especially plants and microbes.

PSO2: Acquisition of knowledge on structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies.

PSO3: Understanding of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

PSO4: Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.

PSO5: Ability to explain the diversity and evolution based on the empirical evidences in morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

PSO6: Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

PSO7: Making aware of the scientific and technological advancements- Information and Communication, Biotechnology and Molecular Biology for further learning and research in all branches of Botany..

PSO8: Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

BOTANY COURSE OUTCOMES (COs):

Semester I (A-1): Microbial Diversity

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 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.

Semester III (A-3): Plant Anatomy and Developmental Biology

1. Observation of variations that exist in internal structure of various parts of a plant and as well as among different plant groups in support for the evolutionary concept.
2. Skill development for the proper description of internal structure using botanical terms, their identification and further classification.
3. Understanding the basic concepts in plant morphogenesis, embryology and organ development.

Semester IV (A-4): Ecology & Conservation Biology

1. Understanding the fundamental concepts in ecology, environmental science and phytogeography.
2. Concept development in conservation, global ecological crisis, Sustainable development and pros and cons of human intervention.
3. Enable the student to appreciate bio diversity and the importance of various conservation strategies, laws and regulatory authorities and global issues related to climate change and sustainable development.

Semester V (A-5): Plant Taxonomy & Resource Botany

1. Ability to identify, classify and describe the plants in scientific terms. Identification of plants using dichotomous keys.
2. Recognition, processing and utilization of economically important plants.
3. Skill development in processing of biomass and plant products as source of food,

healthcare, energy and natural products.

Semester V (A-6): Cell Biology & Genetics

1. Identify the basic principles and current trends in classical genetics and cell biology.
2. Recognize the historical process of the evolution of molecular genetics from classical genetics.
3. Develop theoretical background on molecular genetics to provide a strong support for the student for future research and employability.

Semester VI (A-7): Plant Physiology & Biochemistry

1. Preliminary understanding of the basic functions and intermediary metabolism in a plant body.
2. Awareness on the interdisciplinary nature of botany, chemistry and physics by studying the principles of plant life, growth and reproduction.
3. Recognizing the wonderful mechanism of transport and the Interrelationships existing between metabolic pathways thereby gaining an idea about the importance of plants in the dynamicity of nature.

Semester VI (A-8): Plant Biotechnology

1. Learning of knowledge & skill in plant tissue culture, plant molecular biology and transgenic.
2. Application of plant biotechnology in plant genomics, phylogenetic studies and metabolic engineering.
3. Understanding of new molecular techniques in cell and metabolic manipulations.

Semester VII (A-9): Molecular Biology

1. Understanding the mechanism and concepts of life process at molecular level through central dogma concept.
2. Skill acquiring in the basic molecular biology techniques & characterization of micro-molecules.
3. Acquiring the emerging technology skills in plant genetic engineering & proteomics.

Semester VII (A-10): Seed Biology & Seed Technology

1. Understanding the seed structure and related functions, seed health and productivity.
2. Technology for assessing the seed pathology, purity, and preservation.
3. Learning the field and laboratory protocols of seed production, certification and quality.

Semester VII (A-11): Plant Health Technology

1. Understanding & learning common diseases & control measures of plant diseases.
2. Acquiring skills in plant disease diagnosis, control & management through IPM.
3. Learning of new skills in health clinic through biological methods.

Semester VIII (A-13): Medicinal Plants & Phytochemistry

1. Knowledge of Indian system of medicine with regard to medicinal plants.
2. Acquiring skills in identification, cultivation and preservation of medicinal plants.
3. Isolation, identification, characteristics of active principles in medicinal plants & drug formulations.

Semester VIII (A-14): Bioinformatics & Computational Biology

1. Learning of basic principles of application, ICT Technology in biological studies & research.
2. Acquiring skill to utilize the computational apps, active data basis and tools in analysis in genetics & proteomics.
3. Learning skills and software used for biological research & process understanding.

Semester VIII (A-15): Research Methodology

1. Understanding the working of science for further application in free, independent, individual needs and in designing scientific experimentation.
2. Acquire knowledge on the principles, components and applications of various scientific equipment in biology.
3. Foundation knowledge in the basic concepts, components and functions of informatics and the importance of statistical principles in biological research.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs 1-12)

SEMENAR	Course Outcomes (COs) / Program Outcomes (POs)	1	2	3	4	5	6	7	8	9	10	11	12
1	A-1	X	X	X			X			X			X
2	A-2	X	X	X			X		X	X			X
3	A-3		X	X	X	X		X		X			X
4	A-4			X		X	X	X	X	X	X	X	X
5	A-5, A-6	X	X	X	X	X		X	X	X	X	X	X
6	A-7, A-8					X		X		X		X	X
7	A-9, A-10, A-11					X	X	X		X	X	X	X
8	A-12A-13, A-14,					X	X	X	X	X	X	X	X

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

B.Sc. BOTANY: Semester - 1

Title of the Course: Microbial Diversity and Technology

Number of theory credits	Number of lecture hours/ semester	Number of practical credits	Number of practical hours /semester
4	60	2	56

Content of Theory Course 1		60 Hrs
Unit-1		
<p>Microbial diversity-Introduction to microbial diversity; Whittaker's five-kingdom system and Carl Richard Woese's three-domain system. Distribution of microbes in soil, air, food and water. Significance of microbial diversity in nature.</p> <p>History and developments of microbiology-Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, and M W Beijerinck).</p> <p>Microscopy-Working principle and applications of light, dark field, phase contrast and electron microscopes (SEM and TEM). Microbiological stains (acidic, basic and special) and Principles of staining. Simple, Gram's and differential staining.</p>		15 Hrs
Unit-2		
<p>Culture media for Microbes-Natural and synthetic media, Indicator media, transport media, and storage media.</p> <p>Sterilization methods -Principle of disinfection, and Pasteurization, Sterilization-Sterilization, its types and applications.</p> <p>Microbial Growth-Microbial growth and measurement. Nutritional types of Microbes- autotrophs, heterotrophs, phototrophs, chemotrophs, lithotrophs and organotrophs.</p>		15 Hrs
Unit-3		
<p>Microbial cultures and preservation-Microbial cultures. Pure culture and axenic cultures, subculturing, Preservation methods-overlaying cultures with mineral oils, lyophilisation. Microbial culture collections and their importance. A brief account on ITCC, MTCC and ATCC.</p> <p>Viruses- General structure and classification of Viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-COV-2, Rabies and Bacteriophage (T2). Vaccines and types.</p> <p>Viroids- general characteristics and structure of Potato Spindle Tuber Viroid (PSTVd); Prions - general characters and Prion diseases. Economic importance of viruses.</p>		15 Hrs
Unit-4		
<p>Bacteria- General characteristics and classification (Bergey's classification). Ultrastructure of Bacteria; Bacterial growth and nutrition. Reproduction in bacteria- asexual and sexual methods. Study of <i>Rhizobium</i> and its applications. Economic importance of Bacteria.</p> <p>Fungi-General characteristics and classification. Thallus organization and nutrition</p>		15 Hrs

<p>in fungi. Reproduction in fungi (asexual and sexual). Type study of <i>Trichoderma</i>, <i>Rhizopus</i>, <i>Penicillium</i> and <i>Puccinia</i>. Economic importance of Fungi.</p> <p>Plant diseases- Black stem rust of wheat; Downy Mildew of Bajra, Grain smut of Sorghum, Sandal Spike, Citrus Canker.</p> <p>Lichens – Structure and reproduction. VAM Fungi and their significance.</p>	
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Text Books

1. Ananthnarayan R and Panikar JCK. 1986. Text book of Microbiology. Orient Longman ltd. New Delhi.
2. Arora DR. 2004. Textbook of Microbiology, CBS, New Delhi.
3. William CG. 1989. Understanding microbes. A laboratory text book for Microbiology. W.H. Freeman and Company. New York.
4. Dubey RC and Maheshwari DK. 2007. A textbook of Microbiology, S. Chand and Company, New Delhi.
5. Dubey RC and Maheshwari DK. 2002. A Text book of Microbiology, S.C.Chand and Company, Ltd. Ramnagar, New Delhi.
6. Sharma R. 2006. Text book 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, Ingrahan 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.

Pedagogy:

Lectures, Practical, 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
Seminar	10
Assignment	05
Attendance	05
Total	40

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 etc.).
Practical 2	:	Enumeration of soil/food /seed microorganisms by serial dilution technique.
Practical 3	:	Preparation of culture media (NA/PDA) sterilization, inoculation, incubation of <i>E. coli</i> / <i>B. subtilis</i> / Fungi and study of cultural characteristics.
Practical 4	:	Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer.
Practical 5	:	Simple staining of bacteria (Crystal violet /Nigrosine blue) / Gram's staining of bacteria.
Practical 6	:	Isolation and study of morphology of <i>Rhizobium</i> from root nodules of legumes
Practical 7	:	Preparation of spawn and cultivation of paddy straw (Oyster) mushroom.
Practical 8	:	Study of vegetative structures and reproductive structures - <i>Rhizopus/Mucor</i> , <i>Aspergillus/Penicillium</i> , <i>Phytophthora/Pythium</i> , <i>Albugo</i> , <i>Saccharomyces</i> , <i>Neurospora/Sordaria</i> , <i>Trichoderma</i> , <i>Lycoperdon</i> , <i>Puccinia</i> , <i>Agaricus</i> , (Depending on local availability).
Practical	:	Study of late blight of Potato, Downy mildew of Bajra, Citrus canker,

9		Tobacco mosaic disease, Sandal spike disease.
Practical 10	:	Study of well-known microbiologists and their contributions through charts and photographs.
Practical 11	:	Preparation of agar slants, inoculation, incubation, pure culturing and preservation of microbes by oil overlaying.
Practical 12	:	Visit to water purification units/ composting/ microbiology labs/dairy and farms to understand role of microbes in day today life.

B.Sc. BOTANY: Semester – 2

Title of the Course: Diversity of Non- Flowering Plants

Number of theory credits	Number of lecture hours/ semester	Number of practical credits	Number of practical hours /semester
4	60	2	56

Content of Theory Course 1			60 Hrs
Unit-1			
Algae –Introduction, General characteristics and classification of algae, Diversity -thallus organization, pigments, reserve food, flagella types, life-cycle and alternation of generation in Algae. Distribution of Algae. Morphology, reproduction and life-cycles of <i>Nostoc</i> , <i>Oedogonium</i> , <i>Chara</i> , and <i>Sargassum</i> Diatoms and their importance. Blue-green algae and their importance. Algal blooms and toxins. Algal cultivation - cultivation of microalgae- <i>Spirulina</i> and <i>Dunaliella</i> ; Algal cultivation methods in India. Algal products - Food and Nutraceuticals, Feed stocks, food colorants; fertilizers, aquaculture feed; therapeutics and cosmetics; medicines; dietary fibres from algae and uses.			15 Hrs
Unit-2			
Bryophytes – General characteristics and classification of Bryophytes, Diversity-habitat, thallus structure, Gametophytes and sporophytes. Distribution, morphology, anatomy, reproduction and life-cycles of <i>Riccia</i> , <i>Marchantia</i> , <i>Anthoceros</i> and <i>Funaria</i> . Ecological and economic importance of Bryophytes. Fossil Bryophytes. Pteridophytes - General characteristics and classification. Distribution, morphology, anatomy, reproduction and life-cycles in <i>Selaginella</i> , <i>Lycopodium</i> , <i>Equisetum</i> , <i>Pteris</i> and <i>Salvinia</i> .			15 Hrs
Unit-3			
A brief account of heterospory and seed habit. Stellar evolution in Pteridophytes. Ecological and economic importance. Gymnosperms - General characteristics. and classification of Gymnosperms. Distribution, Morphology, anatomy, reproduction and life-cycles in <i>Cycas</i> , <i>Pinus</i> and <i>Gnetum</i> .			15 Hrs

Economic importance of Gymnosperms - food, timber, industrial uses and medicines.	
Unit-4	
Origin and evolution of plants: Origin and evolution of plants through Geological Time scale. Paleobotany- Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating. Fossil taxa- <i>Rhynia</i> , <i>Lepidodendron</i> and <i>Lepidocarpon</i> . Exploration of fossil fuels. Birbal Sahni Institute of Paleosciences.	15 Hrs

Text Books

- Chopra GL. 1998. A text book of Algae. Rastogi & Co., Meerut, Co., New Delhi, Depot. Allahabad.
- Johri L and Tyagi. 2012, A Text Book of, Vedam e Books, New Delhi.
- Sharma OP.1990. Text Book of Pteridophyta. McMillan India Ltd. New Delhi.
- Sharma OP.1992. Text Book of Thallophytes. McGraw Hill Publishing Co. New Delhi.
- Sharma O.P.2017. Algae Singh-Pande-Jain 2004-05. A Text Book of Botany. Rastogi Publication, Meerut.

References

- Sambamurthy AVSS. 2005. A Text Book of Algae. I.K. International Private Ltd., New Delhi.
- Agashe SN.1995. Paleobotany. Plants of the past, their evolution. Paleoenvironment and Allied plants. Hutchinson & Co., Ltd., London.
- Anderson RA. 2005, Algal cultural techniques, Elsevier, London publication, Application in exploration of fossil fuels. Oxford & IBH., New Delhi.
- Eams AJ.1974. Morphology of vascular plants - Lower groups. Tata Mc Graw-Hill Publishing Co. New Delhi, Freeman & Co., New York.
- Fritze RE. 1977. Structure and reproduction of Algae. Cambridge University Press.
- Goffinet B and Shaw AJ. 2009. Bryophyte Biology, 2nd ed. Cambridge University Press, Cambridge. Gymnosperms.
- Srivastava HN. 2003. Algae Pradeep Publication, Jalandhar, India.
- Kakkar RK and Kakkar BR.1995. The Gymnosperms (Fossils and Living) Central Publishing House, Allahabad.
- Kumar HD. 1999. Introductory Phycology, Affiliated East-West Press, Delhi.
- Lee RE. 2008. Phycology, Cambridge University Press, Cambridge. 4th edition. McGraw Hill Publishing Co., New Delhi.
- Parihar NS. 1970. An Introduction to Embryophyta. Vol. I. Bryophyta. Central Book, Allahabad.
- Parihar NS. 1976. An Introduction to Pteridophytes, Central Book Depot,

Allhabad.

- Parihar NS. 1977. The Morphology of Pteridophytes. Central Book Depot, Allahabad. Press, Cambridge.
- Rashid A. 1998. An Introduction to Pteridophyta. II ed., Vikas Publishing House, New Delhi.
- Smith GM. 1971. Cryptogamic Botany. Vol. II. Bryophytes & Pteridophytes. Tata McGraw Hill Publishing, New Delhi.
- Smith GM. 1971. Cryptogamic Botany. Vol. I Algae & Fungi. Tata McGraw Hill Publishing, New Delhi.
- Sporne KR. 1965. The Morphology of Gymnosperms. Hutchinson & Co., Ltd., London.
- Stewart WM. 1983. Paleobotany and the Evolution of Plants, Cambridge University Cambridge.
- Sundarajan S. 1997. College Botany Vol. I. S Chand & Co. Ltd., New Delhi.
- Vanderpoorten A and Goffinet B. 2009, Introduction to Bryophytes, Cambridge University Press, Cambridge.
- Vashista BR. 1978. Bryophytes. S Chand & Co. Ltd., New Delhi.

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

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
I Test	10
II Test	10
Seminar	10
Assignment	05
Attendance	05
Total	40

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

Practical 1	:	Study of morphology, classification, reproduction and life cycle of <i>Nostoc/ Oscillatoria</i> .
Practical 2	:	Study of morphology, classification, reproduction and life-cycle of <i>Oedogonium</i> , <i>Chara</i> , <i>Sargassum</i> , <i>Batrachospermum/ Polysiphonia</i> .
Practical 3	:	Study of morphology, classification, reproduction and life-cycle of <i>Riccia</i> and <i>Anthoceros</i> .
Practical 4	:	Study of morphology, classification, anatomy, reproduction and life-cycle of <i>Selaginella</i> and <i>Equisetum</i> .
Practical 5	:	Study of morphology, classification, anatomy, reproduction and life-cycle of <i>Pteris</i> and <i>Azolla</i> .

Practical 6	:	Study of morphology, classification, anatomy and reproduction in <i>Cycas</i> .
Practical 7	:	Study of morphology, classification & anatomy, reproduction in <i>Pinus</i> .
Practical 8	:	Study of morphology, classification & anatomy, reproduction in <i>Gnetum</i> .
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 <i>Azolla</i> in artificial ponds.
Practical 12	:	Media preparation and cultivation of <i>Spirulina</i> .
Practical 13	:	Study different algal products and fossils impressions and slides.
Practical 14	:	Visit to 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 study report is compulsory).

B.Sc. BOTANY: Open Elective Course (OE-1.1)

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

Number of Theory Credits	Number of Lecture hours/ Semester	Number of Practical Credits	Number of Practical Hours/ Semester
3	30	0	00
Contents of Theory Course 1			30 Hrs
Unit-1			
Origin of Cultivated Plants. Concept of Centres of Origin, their importance			10

<p>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 bio- diversity and conservation.</p> <p>Cereals: Wheat and Rice (origin, evolution, morphology, post-harvest processing & uses). Green revolution. Brief account of millets and their nutritional importance.</p> <p>Legumes: General account (including chief pulses grown in Karnataka- red gram, green gram, chick pea, soybean). Importance to man and ecosystem.</p>	
Unit-2	
<p>Cash crops: Morphology, new varieties and processing of sugarcane, products and by-products of sugarcane industry. Natural Rubber –cultivation, tapping and processing.</p> <p>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.</p> <p>Fruits: Mango, grapes and Citrus (Origin, morphology, cultivation, processing and uses)</p> <p>Beverages: Tea, Coffee (morphology, processing & uses)</p>	10
Unit-3	
<p>Oils and fats: General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family & uses). Non edible oil yielding trees and importance as biofuel. Neem oil and applications.</p> <p>Essential Oils: General account. Extraction methods of sandal wood oil, rosa oil and eucalyptus oil. Economic importance as medicine, perfumes and insect repellents.</p> <p>Drug-yielding plants: Therapeutic and habit-forming drugs with special reference to Cinchona, Digitalis, Aloe vera and Cannabis.</p> <p>Fibers: Classification based on the origin of fibers; Cotton and jute (origin morphology, processing and uses).</p>	10

Text Books and References

1. Kochhar SL. 2012. Economic Botany in Tropics. New Delhi, India: MacMillan & Co.
2. Wickens GE. 2001. Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.
3. Chrispeels MJ and Sadava DE. 1994. Plants, Genes and Agriculture. Jones & Bartlett - Publishers.

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
Total	30

B.Sc. BOTANY: Open Elective Course (OE-1.2)
I Semester

Title of the Course: Botany for the Beginners

Course Outcome:

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

1. To make the students familiar with importance of botany, plants as natural resources.
2. To make the students known about the plants used as-food, medicinal value and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of plants in day today life, ecosystem restoration.

Number of Theory Credits	Number of Lecture hours/ Semester	Number of Practical Credits	Number of Practical Hours/ Semester
3	30	0	00
Contents of Theory Course 1			30 Hrs
Unit-1			
Living World 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 bio- diversity and conservation. Concept of Living and Non Living: Viruses, Bacteria, Fungi, Plants and Animals; Five kingdom Classification- Classification of plants- Eichler's system – general characters of groups- An introduction to the Life cycle of plants. Cell Structure-Prokaryote and eukaryote			10
Unit-2			
Morphology of Angiosperms, Origin and Evolution of Life Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed. Flower: Basic structure - essential and non-essential whorls. Definition, Ancient Concepts and Modern Concepts. Origin of Life –			10

Geological Time scale – Variation in Hydrosphere, Lithosphere, Atmosphere and Biosphere from Pre Cambrian to Coenozoic era. Darwin's Natural Selection theory and Modern evidences at molecular and organismic level in support of Darwin's theory	
Unit-3	
Interaction between plants and animals General concept on Interaction between plants, microbes and animals. Ecological Significance of Plants – Solar energy fixing Producers, Nitrogen fixation, biofertilisers, biopesticides, Symbiotic relationships-Mutualism, Commensalism, Protoco-operation, Parasitism. Plants and Animals for pollination and seed/fruit dispersal- Pollination- Entomophily, Chiropterophily, Myrmecophily Seed Dispersal: Zoochory, Specific case studies on examples for co evolution- Dodo and Calvaria, Butterflies and plants; Wasps and Ficus, mimicking for pollinators. Medicinal uses of plants – traditional knowledge and scientific knowledge – a brief account	10

Text Books and References

1. Agarwal SK. 2009. Foundation Course in Biology, Ane Books Pvt. Ltd., New Delhi.
2. Datta AC. 2000. Class Book of Botany
3. Rao M. 2009. Microbes and Non flowering plants-impacts and applications, Ane Books, Pvt Ltd, New Delhi.
4. Pandey BP.2001. College Botany, Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd, New Delhi. Singh P. 2007. An introduction to Biodiversity- Ane Books India, New Delhi
5. Raven PH, Johnson GB, Losos JB, Singer SR. 2005. Biology, seventh edition, Tata McGraw-Hill, New Delhi
6. Wallace RA. 1992. Biology, The world of life. Harper Collins Publishers

Pedagogy:

Lectures, Practical, 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
Total	30

B.Sc. BOTANY: Open Elective Course (OE-1.3)

I Semester

Title of the Course : Mushroom Cultivation

Course Outcome:

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

1. To make the students familiar with mushroom cultivation for commercial exploitation.
2. To make the students known about the *Agaricus* (mushroom) used as food, medicine and economic value for sustainable development.
3. To generate interest amongst the students to know the importance of mushroom in day today life.

Number of Theory Credits	Number of Lecture hours/ Semester	Number of Practical Credits	Number of Practical Hours/ Semester
3	30	0	00
Contents of Theory Course 1			30 Hrs
Unit-1			
Mycology and Mushroom Biology Five kingdom classification of organisms. Kingdom fungi. General characters of form, function, reproduction and relationship with other organisms. Importance of fungi in human welfare. Morphology (range of form, macro-morphology, micro-morphology), life cycle of a typical mushroom and biological function. Edible, non-edible and poisonous species. Domestication of mushroom. Importance of mushroom in human nutrition, sustainable livelihood, ecosystem function and quality of the environment.			10
Unit-2			
Applied Mushroom Biology Mushroom cultivation and production. Lab scale, pilot plant and large scale cultivation of commercial species. Crop cycle- spawn, substrate, substrate processing, spawning, spawn run, cropping, harvesting, environment requirement, post-harvest practices, shelf life, preservation, storage, transport and marketing. Value-added products of mushroom. Constraints and environment management. Economics of mushroom cultivation. Designs of mushroom facility. Economics of mushroom cultivation and marketing.			10
Unit-3			
Mushroom Biotechnology Concept. Preparation of flavours, appetizers, nutraceuticals, dietary supplements and cosmetics. Mushroom bioremediation. Cleaning of polluted sites .Utilization of mushroom mycelium or enzymes in recycling biological materials. Mycofiltration and applications of the process. Mycorrhiza			10

applications. Biopulping, biobleaching and biotransformations. Biodetergents.	
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References

- Singh H. 1991. Mushrooms: the art of Cultivation. Sterling Publishers.
- Kaul TN. 2001. Biology and conservation of Mushrooms. Oxford and IBH Publishing Company.
- Tripathi M. 2019. Mushroom Cultivation. Oxford and IBH Publishing Company.
- Suman BC and Sharma VP. 2007. Mushroom Cultivation in India. Eastern Book Corporation.
- Singh R and Singh UC. 2005. Modern Mushroom Cultivation. Agrobios.

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
Total	30

B.Sc. BOTANY: Open Elective Course (OE-2.1)

II Semester

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

Paper 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 interest in nature and plant life.

Number of Theory Credits	Number of Lecture hours/ Semester	Number of Practical Credits	Number of Practical Hours/ Semester
3	30	0	00

Contents of Theory Course 1		30 Hrs
Unit-1		
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. 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.	10 Hrs	
Unit-2		
Vegetative propagation Air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings. Hardening of plants. Green house, mist chamber, shed root, shade house and glass house. Gardening Definition, objectives and scope. Different types of gardening - landscape and home/terrace gardening, parks and its components. Plant materials and design.	10 Hrs	
Unit-3		
Computer applications in landscaping, Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting. 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.	10 Hrs	

Text Books and References

- Agrawal PK. 1993. Hand Book of Seed Technology. New Delhi, Delhi: Dept. of Agriculture and Cooperation, National Seed Corporation Ltd.
- Bose TK and Mukherjee D. 1972. Gardening in India. New Delhi, Delhi: Oxford & IBH Publishing Co.
- Jules J. 1979. Horticultural Science, 3rd edition. San Francisco, California: W.H. Freeman and Co.
- Kumar N. 1997. Introduction to Horticulture. Nagercoil, Tamil Nadu: Rajalakshmi Publications.

Additional Resources:

- Musser E., Andres. 2005. Fundamentals of Horticulture. New Delhi, Delhi: McGraw Hill Book Co.
- Sandhu MK. 1989. Plant Propagation. Madras, Bangalore: Wile Eastern Ltd.

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
Total	30

B.Sc. BOTANY: Open Elective Course (OE-2.2)

II Semester

Title of the Course: Bio-fuels

Paper Outcome:

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

Number of Theory Credits	Number of Lecture hours/ Semester	Number of Practical Credits	Number of Practical Hours/ Semester
3	30	0	00
Contents of Theory Course 1			30 Hrs
Unit-1			
Introduction, definition, scope and Importance of Bio-fuel. Institutions related to biofuels in India and worldwide. Public awareness of biofuel. Biofuels scenario -in India and worldwide. History of biofuel; Advantages and disadvantages of biofuels. Generation of biofuels: first, second, third and fourth generation of biofuels and present status.			10 Hrs
Unit-2			
Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance.(Biomass-plant, animal and microbial based waste). Algal biofuel. Biodiesel species: <i>Pongamia pinnata</i> , <i>Simarouba gluca</i> , <i>Jatropha curcas</i> , <i>Azardirachta india</i> , <i>madhuca indica</i> and <i>Callophyllum innophyllum</i> etc.; oil content analysis and characterization.			10 Hrs
Unit-3			
Introduction to biodiesel, bioethanol, biogas and biohydrogen; production technology of biofuels, quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; Biofuel Policy in India and around the worldwide; Biofuel			10 Hrs

production statistics: production of Biodiesel, bioethanol, biogas in Countrywide	
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Text Books and References

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
Total	30

B.Sc. BOTANY: Open Elective Course (OE-2.3)

II Semester

Title of the Course: Bio-fertilizers

Paper Outcome:

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

Number of Theory Credits	Number of Lecture hours/ Semester	Number of Practical Credits	Number of Practical Hours/ Semester
3	30	0	00
Contents of Theory Course 1			30 Hrs
Unit-1			
General account, isolation and mass multiplication General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis. <i>Azospirillum</i> : isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. <i>Azotobacter</i> : classification, characteristics – crop response to <i>Azotobacter</i> inoculum, maintenance and mass multiplication			10 Hrs
Unit-2			
Association of cyanobacteria and fungi			10

Cyanobacteria (blue green algae), <i>Azolla</i> and <i>Anabaena Azollae</i> association, nitrogen fixation, factors affecting growth, blue green algae and <i>Azolla</i> in rice cultivation Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM –its influence on growth and yield of crop plants	Hrs
Unit-3	
Applications of cyanobacteria and fungi Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – bio-compost making methods, types and method of vermin-composting – field Application.	10 Hrs

Suggested Readings

- Dubey R. 2005. A Text book of Biotechnology S.Chand & Co, New Delhi.
- Kumaresan V. 2005. Biotechnology, Saras Publications, New Delhi.
- Prakash JJE. 2004. Outlines of Plant Biotechnology. Emkay _Publication, New Delhi.
- Sathe TV. 2004. Vermiculture and Organic Farming. Daya publishers.
- Rao NS. 2000. Soil Microbiology, Oxford & IBH Publishers, New Delhi.
- Vayas SC, Vayas S and Modi HA.1998. Bio-fertilizers and organic farming Akta Prakashan, Nadiad

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
Total	30

DAVANGERE UNIVERSITY
I Semester B.Sc. Botany Degree Examination- January 2022
(NEP-2020)

Paper-I: Microbial Diversity and Technology

Time: 2 Hours

Maximum Marks: 60

Note:

- i) All Parts are compulsory
- ii) Draw labeled diagram whenever necessary

PART-A

I. Write brief note on any **FIVE** of the following

2x 10=10 M

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.

PART-B

II. Write short notes on any **FIVE** of the following

5x4=20 M

- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.
- 16.

PART-C

Answer any **THREE** of the following

3x10=30M

- 17.
- 18.
- 19.
- 20.
- 21.

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