

**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY**  
**Jnanasagara campus, Bellary-583105**



**Bachelor of Science in Botany**

**Syllabus for semester – I**

**Effective from Academic Year 2021-22**

**(Revised as per NEP-2020)**

## **PROGRAM OUTCOME**

**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 structure, life cycle and life processes that exist among plant and microbial diversity through certain model organism studies

**PO3:** Undertaking of various interactions that exist among plants and microbes; to develop the curiosity on the dynamicity of nature.

**PO4:** Understanding of the major elements of variation that exist in the living world through comparative morphological and anatomical study.

**PO5:** Ability to explain the diversity and evolution based on the empirical evidences in the morphology, anatomy, embryology, physiology, biochemistry, molecular biology and life history.

**PO6:** Skill development for the collection, preservation and recording of information after observation and analysis- from simple illustration to molecular database development.

**PO7:** 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.

**PO8:** Internalization of the concept of conservation and evolution through the channel of spirit of inquiry.

**PO9:** To enable the graduates to prepare for national as well as international level competitive examinations like UGC-CSIR, UPSC, KPSC etc.

**PO10:** To enable the students for practicing the best teaching pedagogy as a biology teacher including the latest digital modules

**PO11:** The graduates should be knowledgeable and competent enough to appropriately deliver on aspects of global importance like climate change, SDG, green technologies etc at the right opportunity

**PO12:** The graduate should be able to demonstrate sufficiently proficiency in the hands-on experimental techniques for their area of specialization within biology during research and in the professional career

## Course Wise Content Details for B.Sc. Botany Programme

### Semester-I

#### DSC-1: 21BSC1C1BOT1L: MICROBIAL DIVERSITY

<b>Course:</b> Microbial diversity	<b>Course code:</b> 21BSC1C1BOT1L
<b>L-T-P per week</b> 4-0-0	<b>No of credits – 04</b>
<b>Internal Assessment:</b> 30 marks	<b>Semester end Examination:</b> 70 marks
<b>Total contact hours:</b> 55	

#### Course Outcome (COs)

At the end of the course the student should be able to understand

**CO1:** Understand the world of microbes, adaptive strategies, reproduction and their economic importance.

**CO2:** Comprehend the systematic position, structure, physiology and life cycles of microbes and their impact on humans and environment.

**CO3:** Gain laboratory skills such as microscopy, microbial cultures, staining, identification, preservation of microbes for their applications in research and industry.

Units	Course content	Hrs
<b>Unit-1</b>	<p><b>Chapter no-1 Microbial diversity:</b> Introduction to microbial diversity; Methods of estimation; 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 soil, air, food and water. Significance of microbial diversity in nature.</p> <p><b>Chapter no-2 History and developments of microbiology:</b> Microbiologists and their contributions (Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Dmitri Iwanowski, Sergius Winogradsky and MW Beijerinck and Paul Ehrlich).</p> <p><b>Chapter no-3 Microscopy:</b> 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>	<b>11 hrs</b>
<b>Unit-2</b>	<p><b>Chapter no – 4: Culture media for microbes:</b> Natural and synthetic media, routine media, basal media, enriched media, selective media, indicator media, transport media and storage media.</p> <p><b>Chapter No-5 Sterilization methods:</b> Principle of disinfection, antiseptic, tyndallization and Pasteurization, sterilization by heat, moist heat, UV light ionization radiation, filtration. Chemical methods of sterilization-phenolic compounds, anionic and cationic detergents.</p> <p><b>Chapter no 6 Microbial growth:</b> Microbial growth and measurement. Nutritional types of microbes – autotrophs and heterotrophs, phototrophs and chemotrophs; lithotrophs and organotrophs.</p>	<b>11 hrs</b>

<b>Unit-3</b>	<p><b>Chapter no 7 Microbial cultures and preservation:</b> 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><b>Chapter no 8 Viruses:</b> General structure and classification of viruses; ICTV system of classification. Structure and multiplication of TMV, SARS-CoV2 and Bacteriophage (T2). Cultivation of viruses. Vaccines and types.</p> <p><b>Chapter no 9 Viroids and Prions:</b> General characteristics and structure of Potato spindle tuber viroid (PSTVd). Prions – general characters and prion diseases. Economic importance of viruses.</p>	<b>11 hrs</b>
<b>Unit-4</b>	<p><b>Chapter no 10 Mycoplasma:</b> – General characteristics, ultra-structure and classification, symptoms caused by MLOs, Sandal spike, little leaf of Vinca rosea, grassy shoot of sugar cane</p> <p><b>Chapter no-11 Bacteria:</b> General characteristics and classification. Archebacteria and Eubacteria. Ultrastructure of bacteria. Bacterial growth and nutrition. Reproduction in bacteria – asexual and sexual methods. Role of bacteria in agriculture and nitrogen fixation</p> <p><b>Chapter no 12 Bacterial diseases:</b> Citrus canker, Black arm of cotton, bacterial soft rot of carrot. Bacterial plasmids and their characteristics. Economic importance of bacteria.</p>	<b>11 hrs</b>
<b>Unit-5</b>	<p><b>Chapter no 13 Fungi:</b> General characteristics and classification. Thallus organization and nutrition in fungi. Reproduction in fungi (asexual and sexual). Heterothallism and parasexuality. Type study of <i>Phytophthora</i>, <i>Rhizopus</i>, <i>Neurospora</i>, <i>Puccinia</i>, <i>Penicillium</i> and <i>Trichoderma</i>.</p> <p><b>Chapter no. 14 Fungal diseases:</b> Late blight of potato, black stem rust of wheat, downy mildew of Bajra, Grain smut of sorghum, Economic importance of Fungi</p> <p><b>Chapter no. 15 Lichens:</b> Systematics of lichenized fungi- history, classification and phylogeny, photobionts and mycobionts. Thallus morphology and anatomy; Growth forms – crustose lichens, foliose lichens, fruticose lichens; Vegetative structures, Attachment organs and appendages</p>	<b>11 hrs</b>

<b>Course:</b> Microbial diversity	<b>Course code:</b> 21BSC1C1BOT1P
<b>L-T-P per week:</b> 0-0-4	<b>No of credits:</b> 02
<b>Internal Assessments:</b> 15 marks	<b>Semester end examination:</b> 35 marks
<b>Total contact hours:</b> 55	

<b>Lab-1 Course content</b>	<b>Hrs</b>
<b>List of the labs to be conducted</b>	<b>56</b>
<ol style="list-style-type: none"> <li>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 etc.</li> <li>2. Enumeration of soil/ food/ seed microorganisms by serial dilution technique.</li> <li>3. Preparation of culture media (nutrient agar/ potato dextrose agar) sterilization, inoculation, incubation of <i>E.coli</i>/ <i>B. subtilis</i>/ Fungi and study of cultural characteristics.</li> </ol>	

4. Determination of cell count by using Haemocytometer and determination of microbial cell dimension by using Micrometer	
5. Simple staining of bacteria (crystal violet/ Nigrosine blue) / Gram's staining of bacteria	
6. Isolation and study of morphology of <i>Rhizobium</i> from root nodules of legumes	
7. Preparation of spawn and cultivation of paddy straw (Oyster) mushroom	
8. Preparation of agar slants, inoculation, pure culturing and preservation of microbes by oil overlaying	
9. Study of late blight of potato, Downy mildew of Bajra, Citrus canker, Tobacco mosaic disease, sandal spike disease.	
10. Study of well-known microbiologists and their contributions through charts and photographs	
11. Visit to water purification units/ composting / microbiology labs/ dairy and farms to understand role of microbes in day today life.	
12. Competent cell preparations	
13. Bacterial transformations	

## 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, 4<sup>th</sup> ed. Eaglewood Cliffs. NJ 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.
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9. Reddy S and Ram 2007. Microbial Physiology. Scientific Publishers, Jodhpur, 385 pp.
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. 587 pp.
12. Roger S, Ingrahan Y, Wheelis JL, Mark L and Page PR. 1990. Microbial World. 5<sup>th</sup> edition. Printice-Hall India, Pvt Ltd. New Delhi.
13. Sullia SB and Shantharam S. 2005. General Microbiology, Oxford and IBH, New Delhi.
14. Thomas H Nash, 2008. Lichen Biology, 3<sup>rd</sup>edn. Cambridge University Press. The Edinburgh Building, Cambridge CB2 8RU, UK.
15. Awasthi DD, 2000. Lichenology in Indian subcontinent: A supplement to "A hand book of lichens" Publisher: M/s Bishen Singh Mahendra Pal Singh, Dehra Dun.

**SEC1: 21BSC1S1BOT1: BIOLOGICAL TECHNIQUES AND SPECIMEN PREPARATIONS IN BOTANY**

<b>Course:</b> Biological techniques and specimen preparations in botany	<b>Course code:</b> 21BSC1S1BOT1
<b>L-T-P per week:</b> 1-0-2	<b>No of credits:</b> 02
<b>Internal Assessment:</b> 15 marks	<b>Semester end Examination:</b> 35 marks
<b>Total contact hours:</b> 27	

**Course Outcomes (COs):**

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

**CO1:** Exposure to collection and preservation of various plant specimens for future challenging studies

**CO2:** Develop critical thinking skill and research aptitude among students, by introducing the frontier areas of the biological science.

<b>Units</b>	<b>Course content – SEC1</b>	<b>27 hrs</b>
Unit-1	<p><b>Collection of plants:</b> Where and how to collect plants, Overview of economically important plants, preparation and storage of herbarium sheets, preparation of dry specimens for display boxes, preparation of museum specimens.</p> <p><b>Anatomy of plants:</b> Collection and preservation of materials for anatomical studies. Special features of anatomical sections of monocot and dicot leaves, stems, rhizomes, and roots. Double staining methods, special staining methods, preparation and storage of permanent slides</p>	<b>09 hrs</b>
Unit-2	<p><b>Cell division stages:</b> stages of mitosis and meiosis in plants, sources of materials, preparation of permanent slides showing stages of division, use of chemicals to arrest division, special stains and their preparation. Making permanent mitosis and meiosis slides.</p> <p><b>Distribution of plants:</b> methods of survey, different approaches of sampling, determination of frequency dominance.</p>	<b>09 hrs</b>
Unit-3	<p><b>Histology and Histochemistry</b> Origin, structure and function of cambia and their derivatives. Seasonal variation in cambial activity, role of cambium in wound healing and grafting. Anomalous cambial activities in <i>Nyctanthus</i>, <i>Amaranthus</i>, <i>Mirabilis</i>, <i>Bougainvillea</i>, <i>Piper</i>, <i>Aristolochia</i>, <i>Thunbergia</i>, <i>Pothos</i>.</p> <p><b>Structure of wood:</b> Soft-wood, hard-wood, sap-wood, heart-wood and role of extractives in wood quality. Wood anatomy of the following wood yielding plants – <i>Atrocarpus integrifolia</i>, <i>Tectona grandis</i>, <i>Dalbergia latifolia</i>, <i>Alanthus malabarica</i>, nodal anatomy, root-stem transition, transfer cells, floral anatomy. Histochemical and ultrastructural aspects of development</p>	<b>09 hrs</b>

**References**

1. Aggarwal SK (2009) Foundation Course in Botany Ane's student's edition
2. Cappucchino JG and Sherman N. Microbiology, A laboratory manual 3<sup>rd</sup> edition. The Benjamin/ Cummings Publishing Co.
3. Dubey RC and Maheshwari DK (2002) Practical Microbiology S Chand & Company Ltd
4. Eldon D, Enger, Fredrick C, Ross and David Bailey (2008) Eleventh edition. Concepts in Biology. Tata- McGraw Hill, New Delhi.
5. Talaro KP and Talaro A (2002) Foundations in Microbiology 4<sup>th</sup> Ed. McGraw Hill
6. Taylor, Green Stout (2008) Biological Science, Cambridge University Press.

## OEC1: 21BSC101BOT1: PLANTS FOR HUMAN WELFARE

<b>Course:</b> Plants for human welfare	<b>Course code:</b> 21BSC101BOT1
<b>L-T-P per week:</b> 4-0-0	<b>No of credits:</b> 03
<b>Internal Assessment:</b> 30 marks	<b>Semester end Examination:</b> 70 marks
<b>Total contact hours:</b> 50	

### Course Outcomes (COs):

**At the end of the course students will be able to:**

**CO1:** Identify edible and nonedible plants and evaluate the values and uses of biodiversity: Ethical and aesthetic values.

**CO2:** Understand and assess importance of cereals, millets, legumes and nuts and their nutrient contents.

**CO3:** Apply skills to manage plant biodiversity

**CO4:** Familiar with names of common fruits, food value and health benefits of fruits of Indian subcontinent (temperate and tropical regions).

**CO5:** Analyse composition of edible portion of common vegetables (earth vegetables, underground stem, herbage vegetables and fruit vegetables).

**CO6:** Identify and classify common spices, condiments and flavouring materials.

**CO7:** Understand the importance of and decide which are the best natural sugars, starches and cellulose products; beverage plants and beverages, and fiber plants for good health.

**CO8:** Assess utility of forests and forest products.

<b>Units</b>	<b>Content of the OEC1</b>	<b>50 hrs</b>
<b>Unit-1</b>	<p><b>Introduction:</b> A general overview of economically important plants and their role in human welfare as food, oil drugs, nutraceuticals, beverages, fibre, timber, biofuels, ornamental and as environment protection through carbon sequestration</p> <p><b>Food crops: Cereals:</b> Origin, cultivation and food values of important crops. Eg., wheat, rice, maize, grain, legumes (pulses), studies pertaining to their improvement through breeding and genetic engineering.</p> <p><b>Spices and condiments:</b> Important spices, structure and their economic values</p> <p><b>Alcoholic and non-alcoholic beverages:</b> Tea, coffee types, processing, uses and improvement</p>	<b>10 hrs</b>
<b>Unit-2</b>	<p><b>Medicinal and nutraceuticals:</b> Traditional plants as source of drugs used against several serious diseases such as cancer, diabetes, malaria, dengue, psoriasis etc. Plant secondary metabolites, classification, roles in human welfare with reference to case studies, knowledge of extraction, isolation and characterization of bioactive metabolites, elicitation of secondary metabolites from anticancerous plants such as <i>Podophyllum</i>, <i>Taxus</i>, <i>Catharanthus</i>, <i>Psoralea</i>, <i>Nordostachys</i>, <i>Piper</i>. Antimalarial plants: <i>Artemisia</i>, <i>Spilanthes</i>, <i>Holarrhena</i> etc. and antidiabetics – <i>Stevia</i>, <i>Gymnema</i>, <i>Momordica</i>, <i>Azadirachta</i> etc. Edible vaccines</p> <p><b>Nutraceuticals and functional foods:</b> Important plants such as <i>Moringa</i>, <i>Piper</i>, <i>Amaranthus</i>, <i>Mentha</i>, Blue berries nuts etc. Nutritionally rich genetically modified plants such as golden rice, flavr-savr tomato.</p>	<b>10 hrs</b>



<b>Unit -3</b>	<p><b>Edible and non-edible oils:</b> Classification of oils, oil yielding plants, processing and purification of different edible oils such as mustard, olive, sunflower oil, safflower peanut oil. Non-edible oils: Jojoba (<i>Simmondsia chinensis</i>), <i>Sesamum indicum</i> oil, Linseed oil, Eucalyptus oil, Citrus oil etc.</p> <p><b>Plant based Biofuels:</b> <i>Jatropha</i>, <i>Pongamia</i>, <i>Zea mays</i>, <i>Madhuca</i> etc. Extraction and economic viability, Application as alternate source of diesels.</p>	<b>10 hrs</b>
<b>Unit-4</b>	<p><b>Plants as a source of timber:</b> <i>Tectona grandis</i>, <i>Salix</i> sp., <i>Dalbergia sisso</i> (sheesham) and fuel wood, type and resources.</p> <p><b>Fibre yielding plants-</b> Cotton (<i>Gossyoiium</i> sp.), Jute (<i>Corchorus</i> sp), sun-hemp (<i>Crotolaria</i> sp) with special reference to current advances pertaining to their improvement through breeding and genetic transformation e.g., Bt-cotton.</p>	<b>10 hrs</b>
<b>Unit-5</b>	<p><b>Plants for Horticulture, floriculture and ornamental values:</b> Brief introduction of different type of horticultural and ornamental plants (carnation, anthurium, orchids etc.) and their commercial aspects; recent development of novel varieties through grafting, breeding and genetic transformation for pigment modification.</p>	<b>10 hrs</b>

#### References

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2. Kochhar SL. 1998. Economic Botany of Tropics, Macmillan India Publishers, New Delhi.
3. Pandey BP. 2000. Economic Botany. S. Chand & Company, New Delhi
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