# MAHATMA GANDHI UNIVERSITY

**Kottayam, Kerala**

**Undergraduate Programmes (HONOURS)**
**2024 Admission Onwards**

| SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **SIGNATURE COURSE** | | | | | | |
| **Name of the College** | SNM College, Maliankara P.O | | | | | |
| **Faculty/ Discipline** | Botany | | | | | |
| **Programme** | BSc (Hons) Botany | | | | | |
| **Course Coordinator** | Dr. Sanilkumar MG | | | | | |
| **Contributors** | Dr. Baiju EC | | | | | |
| **Course Name** | APPLIED MICROBIOLOGY | | | | | |
| **Type of Course** | DSE | | | | | |
| **Specialization title** | Applied Botany | | | | | |
| **Course Code** | To be prepared by the University | | | | | |
| **Course Level** | 200 | | | | | |
| **Course Summary** | The course examines the principles of applied microbiology providing a basic perspective of how microbes are used for the benefit of humans and how these technologies have been developed. The course gives an overview on the utilization and application of microbes in different products and processes | | | | | |
| **Semester** | 3 | **Credits** | | | 4 | **Total Hours** |
| **Course Details** | **Learning Approach** | Lecture | Tutorial | Practical | Others | |
| | | 4 | 0 | 0 | 0 | 60 |
| **Pre-requisites, if any** | Basic knowledge about microorganisms like virus, bacteria, fungus and algae | | | | | |

**Course Outcomes (CO)**

| **Number of COs** | | **4** | |
|---|---|---|---|
| **CO No.** | **Expected Course Outcome** | **Learning Domains *** | **PO No** |
| 1 | To understand the basic history and fundamental aspects of microbiology | U | PO1, PO2, PO4 |
| 2 | To learn the basics of microbial diversity and characterization of microbes | U | PO1, PO2 |
| 3 | To learn applied aspects of microorganism and their advantages along with their conventional economic importance | AN | PO3, PO9 |
| 4 | To understand innovative aspects of microbial products for small scale entrepreneurs | AN | PO3, PO6 |

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**CO-PO Articulation Matrix**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | - | 2 | - | - | - | - | - | - |
| CO 2 | 3 | 3 | - | - | - | - | - | - | - | - |
| CO 3 | - | - | 3 | - | - | - | - | - | 2 | - |
| CO 4 | - | - | 3 | - | - | 3 | - | - | - | - |

*'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).*

**Course Content**

Content for Classroom transaction (Units)

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 1 | Fundamentals of Microbiology, Microbial diversity and Concept of Sterilization | | | |
| | 1.1 | History and scope of microbiology<br>• General introduction of Microbiology<br>• Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Fleming | 4 | ["1"] |
| | 1.2 | • General characteristics of various groups of microorganisms: Eubacteria, Archaebacteria, Actinomycetes, Rickettsiae, Mycoplasma, Chlamydia, Viruses, Algae, Fungi and Protozoa<br>• Importance of microbial diversity<br>• Methods of examining microbial diversity | 4 | ["2"] |
| | 1.3 | • Definition of sterilization, dry and moist heat, pasteurization, tyndalization; radiation, ultrasonication, filtration.<br>• Physical and Chemical methods of sterilization; disinfection sanitization, antisepsis sterilants and fumigation.<br>Activity:<br>Preparation of culture media and its sterilization procedures<br>Demonstration techniques for pure culture of microorganisms – Streak Plate/Pour Plate/Spread Plate/viable plate methods<br>Isolation of bacteria from yoghurt/curd | 7 | ["1"] |
| 2 | Food and Environmental Microbiology and Microbes in the Environment | | | |
| | 2.1 | Fermented Foods<br>• Introduction to fermented foods<br>• Health aspects of fermented foods<br>• Fermented vegetables: Processing and fermentation of pickles and idly.<br>• Diary products :Types of microorganisms in milk<br>• Significance of microorganisms in milk<br>• Microbial products of milk- cheese, yogurt | 5 | ["3"] |
| | 2.2 | Microbial food spoilage and Food poison<br>• Microorganisms as food; Probiotics and Prebiotics<br>• Microbial Spoilage of foods;<br>• Microbial Food poisoning, risks and hazards<br>• Mycotoxins and their poisoning/toxicity | 5 | ["3"] |
| | 2.3 | • Microbes and plant interactions – Rhizosphere, Phyllosphere and Mycorrhizae<br>• Introduction to Microbial Bioremediation, Microbial degradation of organic pollutants<br>Activity:<br>Motility test of bacteria/ Turbidity test of bacteria<br>Catalase activity of $H_2O_2$ production using microorganism<br>Testing sensitivity to antimicrobial substances | 5 | ["4"] |

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 3 | Industrial Microbiology, Fermentation and Industrial products derived from microbes | | | |
| | 3.1 | General Concept of Industrial Microbiology<br>• Principles of exploitation of microorganisms of their products<br>• Screening, strain development & immobilization methods<br>• Fermentation media, raw materials used in media production, antifoaming agents | 5 | ["1"] |
| | 3.2 | Fermentation equipment and its uses<br>• Types of fermentation – single, batch, continuous, multiple, surface, submerged, and solid state fermentation.<br>• Food fermentations and food produced by microbes: bread, cheese, malt beverages, vinegar | 5 | ["2"] |
| | 3.3 | Industrial products derived from microbes<br>• Industrial enzymes – amylase, protease, cellulase.<br>• Amino acids production: glutamic acid and lysine.<br>• Production of antibiotics: penicillin, streptomycin.<br>• Vaccines: genetic recombinant vaccines.<br>• Organic acids: citric acid<br>• Production of alcoholic beverages: beer and wine, Production of biofuels: ethanol, methane, biogas.<br>• Disposal of industrial waste.<br>Activity:<br>Preparation of cheese/curd/wine<br>Demonstration of mushroom cultivation | 5 | ["4"] |
| 4 | Entrepreneurial Microbiology | | | |
| | 4.1 | Microbial products for small scale entrepreneurs<br>• Maintenance of type strains or reference strain of microorganisms: culture collection centres (MTCC, ATCC).<br>• Patenting process and IPR. | 5 | ["2"] |
| | 4.2 | Microorganisms in agriculture<br>• Nitrogen fixation and phosphate solubilization.<br>• Biofertilizers- Production of azolla, rhizobium and mycorrhizae.<br>• Biofungicides- Mass production of Trichoderma and Pseudomonas.<br>• Biopesticides- Bacterial, fungal and viral. | 5 | ["4"] |
| | 4.3 | Metabolic engineering for microbial products<br>• Production of microbial pigments (prodigiosin, violacein, monascin).<br>• Bacterial and algal carotenoids. Microrganisms for flavor and aroma production<br>Activity:<br>Visit to research institution or educational institution with well-equipped microbiology laboratory | 5 | ["4"] |

| | |
|---|---|
| **Teaching and Learning Approach** | **Classroom Procedure (Mode of transaction)**<br>Lab based demonstration, interactive lectures, flipped classroom, lecture-based learning, experiential learning, peer teaching, invited lecture, discussion-based learning, inquiry-based learning, online leaning, blended learning and other innovative learning approaches. |

| | |
|---|---|
| **Assessment Types** | **MODE OF ASSESSMENT**<br>Mode of Assessment: Theory<br><br>**A. Continuous Comprehensive Assessment (CCA)**<br>**• Theory – 30 Marks**<br>● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course Any other method as may be required for specific course / student by the course faculty<br><br>**B. End Semester Evaluation (ESE)**<br>**• Theory – 70 Marks**<br>Assessment Methods – Written Examination<br>Duration of Examination – 2.00 Hrs<br>Pattern of examination for Theory – Non-MCQ<br>Different parts of written examination – Part - A , B , C<br>Answer Type:<br>◦ PART - A<br>◦ Short answer - (10 out of 12 ) – 10 × 2 = 20<br>◦ PART - B<br>◦ Short Essays - (8 out of 10 ) – 8 × 5 = 40<br>◦ PART - C<br>◦ Essays - (1 out of 2 ) – 1 × 10 = 10 |

## References


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- Stuart Hogg (2005) Essential Microbiology, John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex PO19 8SQ, England.

### Suggested Readings

- Tanuka, S., Colin, B. J. and Kumar, D.S. (2019). Microbial Pigments in the Food Industry - Challenges and the Way Forward. Frontiers in Nutrition, 6. Article 7. (ISSN=2296-861X). DOI=10.3389/fnut.2019.00007
- Thakur, M. and Modi, V. K. (2022). Biocolorants in food: Sources, extraction, applications and future prospects. Critical Reviews in Food Science and Nutrition, 64(14), 4674–4713. https://doi.org/10.1080/10408398.2022.2144997.
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## Affidavit

- We, SNM College, Maliankara P.O and Dr. Sanilkumar MG, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, SNM College, Maliankara P.O, agree to appoint a new course coordinator for the proposed Applied Botany in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.
- We, SNM College, Maliankara P.O and Dr. Sanilkumar MG, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.

# MAHATMA GANDHI UNIVERSITY

**Kottayam, Kerala**

**Undergraduate Programmes (HONOURS)**
**2024 Admission Onwards**

| SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **SIGNATURE COURSE** | | | | | | |
| **Name of the College** | SNM College, Maliankara P.O | | | | | |
| **Faculty/ Discipline** | Botany | | | | | |
| **Programme** | BSc (Hons) Botany | | | | | |
| **Course Coordinator** | Dr. Sanilkumar MG | | | | | |
| **Contributors** | Dr. Simi MS | | | | | |
| **Course Name** | APPLIED PHYCOLOGY AND MYCOLOGY | | | | | |
| **Type of Course** | DSE | | | | | |
| **Specialization title** | Applied Botany | | | | | |
| **Course Code** | To be prepared by the University | | | | | |
| **Course Level** | 200 | | | | | |
| **Course Summary** | Lower groups of plants, particularly algae and fungi, are crucial for sustaining life on Earth. Beyond their ecological roles like biodiversity maintenance and primary productivity, they have significant applications in biotechnology. Their contributions are especially notable in agriculture, nutraceuticals, and pharmacology. This syllabus introduces these applied aspects and sets the stage for a detailed exploration of the practical uses of algae and fungi | | | | | |
| **Semester** | 4 | **Credits** | | | 4 | **Total Hours** |
| **Course Details** | **Learning Approach** | Lecture | Tutorial | Practical | Others | |
| | | 4 | 0 | 0 | 0 | 60 |
| **Pre-requisites, if any** | Basic knowledge about lower groups of plants, ie., algae and fungi | | | | | |

**Course Outcomes (CO)**

| **Number of COs** | | **4** | |
|---|---|---|---|
| **CO No.** | **Expected Course Outcome** | **Learning Domains *** | **PO No** |
| 1 | To understand the basic characteristics and usefulness of the algae | U | PO1, PO2 |
| 2 | To learn applied aspects of algae, developments, and advantages along with their conventional economic importance | AN | PO3, PO6, PO10 |
| 3 | To learn the basics of fungal diversity and fermentation and crop management | U | PO1, PO2 |
| 4 | To understand applied mycology in agriculture, food science, and pharmaceuticals | AN | PO3, PO6, PO10 |

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**CO-PO Articulation Matrix**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 2 | - | - | - | - | - | - | - | - |
| CO 2 | - | - | 3 | - | - | 2 | - | - | - | 1 |
| CO 3 | 3 | 2 | - | - | - | - | - | - | - | - |
| CO 4 | - | - | 3 | - | - | 2 | - | - | - | 1 |

*'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).*

**Course Content**

Content for Classroom transaction (Units)

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 1 | Basic characteristics of the algae; The role of algae in biogeochemistry and Biotic associations and technological applications of algae | | | |
| | 1.1 | • Structure of the algal cell<br>• Nutrition<br>• Gene sequencing and algal systematics | 5 | ["1"] |
| | 1.2 | • Cyanobacteria and the origin of an oxygen-rich atmosphere<br>• Algae and the nitrogen cycle<br>Algae and the carbon cycle | 3 | ["1"] |
| | 1.3 | • Types and importance of algal biotic associations<br>• Algal defenses against pathogens<br>• Algal epibionts<br>• Algae as parasites or pathogens algal symbioses<br>• Utilization of algae as research tools<br>• Algae as biomonitors<br>• Algae in space research<br>Genetic Engineering of algae for improved technological performance | 7 | ["2"] |
| 2 | Algal cultivation and extraction, Potential of algae in bioprospecting and Algae in environment and in nutraceuticals | | | |
| | 2.1 | • Fundamentals of microalgae cultivation<br>• Large -scale production of algal biomass: raceway ponds and photobioreactors.<br>• Molecular genetic techniques for algal bioengineering<br>• Extraction and conversion of microalgal lipids<br>• Extraction and conversion of microalgal lipids<br>Commercial production of macroalgae, seaweeds as a component of the human diet | 5 | ["2"] |
| | 2.2 | • Techno-economics of algal biodiesel.<br>• Fuel alcohols from microalgae and seaweeds.<br>• Microalgae for aviation fuels.<br>• Biohydrogen from microalgae.<br>• Food and feed applications of algae.<br>• • Algae and their extracts in medical treatment; application of algae biomass and algae extracts in cosmetic formulations | 5 | ["2"] |
| | 2.3 | • Microalgae applications in wastewater treatment.<br>• Major commercial products from micro- and macroalgae.<br>• The biomass of algae and algal extracts in agricultural production<br>• Harmful algae and their commercial implications.<br>• • Algal nutraceuticals: a perspective on metabolic diversity, current food applications, and prospects in the field of metabolomics.<br><br>Activities: hands on training for agar extraction; Microalgal culturing, familiarization of algae in your locality | 5 | ["3"] |

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 3 | Fungal diversity and food security, Fermentation and crop management and Fungal enzymes and biofuels | | | |
| | 3.1 | • Advances in fungal enzymes and their applications: Fungi as model organisms, earth processes and macroeconomics<br>• Mushroom as a key to food security, human health, and minimizing environmental pollution<br>• • Emergence of mushrooms as novel resources of potential prebiotics.<br>Protocols for extraction, isolation, and purification of secondary metabolites of mushroom and its applications | 5 | ["4"] |
| | 3.2 | • Role of fungi in industry: alcoholic fermentation- baker's yeast and ethanol.<br>• Role of fungi in eco-safety and warfare<br>• Role of fungi in postharvest disease management in horticultural crops<br>Fungal biofertilizers and biopesticides and their roles in sustainable agriculture | 5 | ["3"] |
| | 3.3 | • Advances in fungal enzymes and their applications: diversity of fungal enzymes and their producers (Lipases, proteases and amylases)<br>• Bio-prospecting fungi for hydrocarbons with a potential for biofuels production: Oleaginous yeasts and fungi with potential for biodiesel production<br>Role of fungi in converting agro-residues into cellulase and bioethanol | 5 | ["4"] |
| 4 | Entrepreneurship and nutraceuticals, Agriculture and pharmaceuticals and Fungal interactions | | | |
| | 4.1 | • Fungal endophytes: a potential source of low-cost entrepreneurship<br>• Lichenized fungi as significant source of pharmaceuticals: possibilities and limitations for entrepreneurship development<br>• Fungal cosmetics: mushrooms in beauty care and the new age of natural cosmetics: Application in skincare, hair care and popular mushrooms with cosmetic benefits<br>Fungi as nutraceutical; an overview | 5 | ["4"] |
| | 4.2 | • Fungi in pharmaceuticals and production of antibiotics<br>• Fungal biofertilizer: an alternative for sustainable agriculture:<br>1. Biological Mechanism and Interactions<br>2. Soil mycobiome: pool of promising bioagents for sustainable agriculture<br>• Myco-metabolites in industrial applications with emphasis on bioherbicide production:<br>1. Ecological role of fungi and their metabolites<br>2. Secondary metabolites biosynthesis | 5 | ["3", "4"] |
| | 4.3 | • Plant–fungal interactions<br>• Plant pathogenic fungi and their phytotoxins as bioherbicides<br>• Mycotoxins: a concealed threat in agri-food<br>• Potential of fungi in phenol biodegradation<br>• Mycobased biorefinery for gold nanoparticles production<br>Activities: Familiarization of fungi in your locality (Field trip) and submit a report | 5 | ["4"] |

| | |
|---|---|
| **Teaching and Learning Approach** | **Classroom Procedure (Mode of transaction)**<br>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches. |

| | |
|---|---|
| **Assessment Types** | **MODE OF ASSESSMENT**<br>Mode of Assessment: Theory<br><br>**A. Continuous Comprehensive Assessment (CCA)**<br>**• Theory – 30 Marks**<br>● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course Any other method as may be required for specific course / student by the course faculty<br><br>**B. End Semester Evaluation (ESE)**<br>**• Theory – 70 Marks**<br>Assessment Methods – Written Examination<br>Duration of Examination – 2.00 Hrs<br>Pattern of examination for Theory – Non-MCQ<br>Different parts of written examination – Part - A , B , C<br>Answer Type:<br>◦ PART - A<br>◦ Short answer - (10 out of 12 ) – 10 × 2 = 20<br>◦ PART - B<br>◦ Short Essays - (8 out of 10 ) – 8 × 5 = 40<br>◦ PART - C<br>◦ Essays - (1 out of 2 ) – 1 × 10 = 10 |

## References


- Adetunji et al. 2023. Next generation algae. Vol. I. Application in Agriculture, food and environment. John Wiley and Sons, Beverely, USA
- Alexopoulos, C.J., Mims, C.W. and Blackwell, M., 1996. Introductory Mycology. John Wiley & Sons. Inc., New York, 868.
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- Moheimani, N.R., McHenry, M.P. and Bahri, P.A. 2015. (Ed) Biomass and Biofuels from Microalgae Advances in Engineering and Biology. ISBN 978-3-319-16639-1 ISBN 978-3-319-16640-7 (eBook) DOI 10.1007/978-3-319-16640-7
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## Suggested Readings

- Fritsch, F.E. (Vol. I, II, 1935). The structure and reproduction of Algae. Cambridge University Press.
- Shukla, A.C., 2022. (Ed) Applied Mycology Entrepreneurship with Fungi, Springer, Netherlands

## Affidavit

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**Kottayam, Kerala**

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**2024 Admission Onwards**

| SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **SIGNATURE COURSE** | | | | | | |
| **Name of the College** | SNM College, Maliankara P.O | | | | | |
| **Faculty/ Discipline** | Botany | | | | | |
| **Programme** | BSc (Hons) Botany | | | | | |
| **Course Coordinator** | Dr. Sanilkumar MG | | | | | |
| **Contributors** | Ms Asha A and Dr. Thushara VS | | | | | |
| **Course Name** | APPLIED HORTICULTURE AND ENTREPRENEURSHIP | | | | | |
| **Type of Course** | DSE | | | | | |
| **Specialization title** | Applied Botany | | | | | |
| **Course Code** | To be prepared by the University | | | | | |
| **Course Level** | 300 | | | | | |
| **Course Summary** | In this course, students will be familiarized with the essential tools, components and structures used in garden designing. Exploring eco-friendly practices in garden design can contribute to environmental conservation. They acquire an in-depth understanding of the basics of entrepreneurship. The course will also provide information about various entrepreneurship opportunities available in plant science. | | | | | |
| **Semester** | 5 | **Credits** | | | 4 | **Total Hours** |
| **Course Details** | **Learning Approach** | Lecture | Tutorial | Practical | Others | |
| | | 4 | 0 | 0 | 0 | 60 |
| **Pre-requisites, if any** | Basic understanding about horticulture and entrepreneurship opportunities in Botany. | | | | | |

**Course Outcomes (CO)**

| **Number of COs** | | **4** | |
|---|---|---|---|
| **CO No.** | **Expected Course Outcome** | **Learning Domains *** | **PO No** |
| 1 | Understand the basics of ornamental horticulture and landscaping | K | PO2 |
| 2 | Employ the principles of gardening and commercial floriculture | U | PO3 |
| 3 | Evaluate the principles of entrepreneurship. | E | PO3, PO5, PO8 |
| 4 | Identify different entrepreneurship opportunities available to a student of Botany | AN | PO1, PO6, PO10 |

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**CO-PO Articulation Matrix**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | - | 3 | - | - | - | - | - | - | - | - |
| CO 2 | - | - | 3 | - | - | - | - | - | - | - |
| CO 3 | - | - | 3 | - | 2 | - | - | 1 | - | - |
| CO 4 | 3 | - | - | - | - | 2 | - | - | - | 2 |

*'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).*

**Course Content**

Content for Classroom transaction (Units)

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 1 | Ornamental horticulture | | | |
| | 1.1 | Introduction and scope of gardening<br>Aesthetic values, Gardens in India and types of gardens, Principles of gardening.<br>Introduction, definition, history, importance, scope and division of horticulture. Olericulture, Silviculture. | 5 | ["1"] |
| | 1.2 | Landscaping- Types of plants used in landscaping; climbers, herbs,shrubs, ferns, palms, cacti and succulents. | 5 | ["1"] |
| | 1.3 | Soil: origin, properties and types - formation of soil, Components of soil, Classification of soil, Soil preparation - role of microorganisms and humus. Manures- organic manure –farmyard manure, leaf mould, bone meal, oil cakes compost making - green manuring; methods of manuring- broadcast, seed treatment, foliar application | 5 | ["1"] |
| 2 | Garden and related structures | | | |
| | 2.1 | Garden Tools and adornments, Plant growth regulators in horticulture, uses of growth regulators - natural and synthetic regulators, growth regulators used for inducing rooting, flowering, breaking seed and bud dormancy. | 5 | ["1", "4"] |
| | 2.2 | Scope and importance of commercial floriculture in India, production techniques of ornamental plants like Rose, Jasmine, Gerbera.<br>Activity: I: Collection of ornamental plants from natural habitat and study their morphological description, uses and present your findings as Power Point presentations. | 5 | ["2", "3"] |
| | 2.3 | Principles, methods, merits and demerits of training and pruning of fruit crops, Mulching- objectives merits and demerits, weed management. Methods of weed control: physical, chemical and biological methods. Integrated weed management; Plant propagating structures –green house, glass house, hot bed, lath house, net house, and mist chamber | 5 | ["2", "3", "4"] |
| 3 | Basics of Entrepreneurship | | | |
| | 3.1 | Entrepreneurship: Definition; Key Characteristics of Entrepreneurs; Types of Entrepreneurships. | 3 | ["3"] |
| | 3.2 | Essential Skills for Entrepreneurs; Steps in the Entrepreneurial Process;<br>Classification/Types of Entrepreneur: Based on Functional characteristics; Based on the type of business; Based on the stages of development; Based on motivational aspects; Based on technological aspects.<br>Activity: Activity: Familiarization with different successfully entrepreneur ventures related to plant science in Kerala. Submit a report detailing any 2 ventures | 6 | ["3"] |
| | 3.3 | Entrepreneurship development efforts by state and central government: Kerala Startup Mission (KSUM); KIED – Kerala Institute for Entrepreneurship development; The Innovation and Entrepreneurship Development Centers (IEDC); Startup India; Entrepreneurship Skill Development Programme (ESDP). | 6 | ["3"] |

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 4 | Entrepreneurship opportunities in Botany | | | |
| | 4.1 | Horticultural: Plant nurseries; Plant tissue culture; Flower growing; Flower arrangement, Landscaping; Dry flower art – resin art; Bonsai. | 5 | ["4"] |
| | 4.2 | Microgreen; Mushroom cultivation; Hydroponics; Container farming; Precision farming; Farming tourism; Organic Vegetable farming; Supply chain for Organic produces; | 5 | ["4"] |
| | 4.3 | Herbal cosmetic products; Food processing and value addition. Food supplements. | 5 | ["4"] |

| | |
|---|---|
| **Teaching and Learning Approach** | **Classroom Procedure (Mode of transaction)**<br>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches |

| | |
|---|---|
| **Assessment Types** | **MODE OF ASSESSMENT**<br>Mode of Assessment: Theory<br><br>**A. Continuous Comprehensive Assessment (CCA)**<br>**• Theory – 30 Marks**<br>● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article (<5 years) related to the course ● Any other method as may be required for specific course / student by the course faculty.<br><br>**B. End Semester Evaluation (ESE)**<br>**• Theory – 70 Marks**<br>Assessment Methods – Written Examination<br>Duration of Examination – 2.00 Hrs<br>Pattern of examination for Theory – Non-MCQ<br>Different parts of written examination – Part - A , B , C<br>Answer Type:<br>◦ PART - A<br>◦ Short answer - (10 out of 12 ) – 10 × 2 = 20<br>◦ PART - B<br>◦ Short Essays - (8 out of 10 ) – 8 × 5 = 40<br>◦ PART - C<br>◦ Essays - (1 out of 2 ) – 1 × 10 = 10 |



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- Rao, K. M., (2005). Textbook of Horticulture (2nd edition). MacMillan India Limited.
- Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd. (2013) Entrepreneurship.McGraw-Hill.


### Suggested Readings


- Sundaram,V. 2016. Textbook on Commercial flowers and Ornamental Gardening. Kalyani Publishers.
- Swarup, V., (1997). Ornamental Horticulture. MacMillan India Ltd., UK.


## Affidavit

- We, SNM College, Maliankara P.O and Dr. Sanilkumar MG, retain the copyright of this syllabus and expressly prohibit its distribution in complete form to any institution outside our own.
- We, SNM College, Maliankara P.O, agree to appoint a new course coordinator for the proposed Applied Botany in the event of the unavailability of the currently nominated coordinator. This appointment will ensure the continued coordination of course delivery, assessments, and all related academic responsibilities necessary for the successful implementation of the specialization, for as long as the college offers this programme.
- We, SNM College, Maliankara P.O and Dr. Sanilkumar MG, declare that no part of this signature course submitted here for approval has been taken from the course content developed by, or from any of the course titles prepared by, the BoS/expert committee in the same discipline under our University.

# MAHATMA GANDHI UNIVERSITY

**Kottayam, Kerala**

**Undergraduate Programmes (HONOURS)**
**2024 Admission Onwards**

| SYLLABUS | | | | | | |
|---|---|---|---|---|---|---|
| **SIGNATURE COURSE** | | | | | | |
| **Name of the College** | SNM College, Maliankara P.O | | | | | |
| **Faculty/ Discipline** | Botany | | | | | |
| **Programme** | BSc (Hons) Botany | | | | | |
| **Course Coordinator** | Dr. Sanilkumar MG | | | | | |
| **Contributors** | Dr Baiju EC and Dr. Simi MS | | | | | |
| **Course Name** | MEDICINAL AND AROMATIC PLANTS IN APPLIED SCIENCE | | | | | |
| **Type of Course** | DSE | | | | | |
| **Specialization title** | Applied Botany | | | | | |
| **Course Code** | To be prepared by the University | | | | | |
| **Course Level** | 300 | | | | | |
| **Course Summary** | Medicinal and aromatic plants in applied science provides an in depth understanding of the cultivation, processing, and applications of medicinal aromatic plants. It covers the importance o medicinal plants, their conservations. Students learn about the various extraction techniques, separation techniques and characterization methods use in analysis of medicinal and aromatic plants. | | | | | |
| **Semester** | 6 | **Credits** | | | 4 | **Total Hours** |
| **Course Details** | **Learning Approach** | Lecture | Tutorial | Practical | Others | |
| | | 3 | 0 | 1 | 0 | 75 |
| **Pre-requisites, if any** | The field of medicinal and aromatic plants draws from various disciplines, so a broad scientific background can be beneficial. | | | | | |

**Course Outcomes (CO)**

| **Number of COs** | | **5** | |
|---|---|---|---|
| **CO No.** | **Expected Course Outcome** | **Learning Domains *** | **PO No** |
| 1 | To understand the importance of medicinal and aromatic plants in traditional medicine and industry. | U | PO6 |
| 2 | To learn about the cultivation and processing of medicinal and aromatic plants. | AN | PO2 |
| 3 | To study the chemical composition and properties of medicinal and aromatic plants and their application in modern world | AN | PO1, PO2, PO3, PO6, PO9 |
| 4 | To understand the application of medicinal and aromatic plants in pharmaceuticals, cosmetics and other industries. | U | PO1, PO3 |
| 5 | Familiarize with the common separation and characterization techniques | AN | PO1, PO2, PO9 |

**Remember (K), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C), Skill (S), Interest (I) and Appreciation (Ap)*

**CO-PO Articulation Matrix**

| CO/PO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | - | - | - | - | - | 3 | - | - | - | - |
| CO 2 | - | 3 | - | - | - | - | - | - | - | - |
| CO 3 | 3 | 2 | 3 | - | - | 2 | - | - | 3 | - |
| CO 4 | 3 | - | 2 | - | - | - | - | - | - | - |
| CO 5 | 3 | 2 | - | - | - | - | - | - | 2 | - |

*'0' is No Correlation, '1' is Slight Correlation (Low level), '2' is Moderate Correlation (Medium level) and '3' is Substantial Correlation (High level).*

**Course Content**

Content for Classroom transaction (Units)

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 1 | Introduction to Medicinal and Aromatic plants | | | |
| | 1.1 | Definition, importance, history of uses and future prospects of medicinal and aromatic plants. Medicinal Plants – past and present status in world and India. Medicinal plant diversity and local healthcare. Medicinal plant conservation – issues and approaches. | 5 | ["1", "2"] |
| | 1.2 | Promotion of medicinal plant sector at national level: National Medicinal Plant Board and State Medicinal Plant Boards - objectives and functions. Other organizational initiatives for promotion of Medicinal and aromatic plants at National and International levels. Demand and supply of medicinal plants. Herbal industries. IPR issues on medicinal and aromatic plants | 7 | ["2"] |
| | 1.3 | Cultivation-Principles, methods, factors affecting the growth and quality of medicinal and aromatic plants. | 3 | ["2"] |
| 2 | Processing of medicinal and aromatic plants | | | |
| | 2.1 | Methods of processing of medicinal and aromatic plants- drying, storage and preservation, quality control and standardization. | 4 | ["2"] |
| | 2.2 | Extraction techniques- Supercritical fluid extraction (SFE), Microwave-Assisted Hydrodistillation (MAHD), Ultrasound-assisted extraction (UAE), Solvent-free microwave extraction (SFME), Microwave hydro diffusion and gravity (MHG). | 4 | ["5"] |
| | 2.3 | Separation techniques- TLC, Column Chromatography, HPLC; Characterization techniques- GC-MS, LC-MS/MS, UV-VIS Spectrometry, IR Spectrometry, N M R | 7 | ["5"] |
| 3 | Application of medicinal and aromatic plants | | | |
| | 3.1 | Applications- Pharmaceutical, food and beverage, cosmetic and other industrial application | 4 | ["3", "4"] |
| | 3.2 | Biotechnical advances in medicinal plants; Basic tools and technology for Molecular Herbal Biotechnology; basic concepts of genetic engineering, gene bank and gene pool; concepts and basic techniques in plant tissue culture. Genetic transformation and secondary metabolite production | 6 | ["3"] |
| | 3.3 | Applications in Nanotechnology<br>Study of aroma compounds and value addition. Nano-processing technology in medicinal and aromatic plants | 5 | ["3"] |

| Module | Units | Course Description | Hrs | CO No. |
|---|---|---|---|---|
| 4 | Practical | | | |
| | 4.1 | Collection and identification of important medicinal and aromatic plants<br>Extraction of the active principles of local medicinal, aromatic plants. (Any five types)<br>Demonstrate TLC and column chromatography<br>Visit to a phytochemical industry<br>Interaction with subject expert in the field of Ayurvedic medicine for industrial exposure | 30 | ["1", "2", "4", "5"] |

| | |
|---|---|
| **Teaching and Learning Approach** | **Classroom Procedure (Mode of transaction)**<br>Field based collection and interactions, Interactive lectures, flipped classroom, Lecture-based Learning, Project-Based Learning, Experiential Learning, Peer Teaching, invited lecture, Discussion-based Learning, Inquiry-Based Learning, Online Learning, Blended Learning, and other innovative learning approaches. |

| | |
|---|---|
| **Assessment Types** | **MODE OF ASSESSMENT**<br>Mode of Assessment: Both<br><br>**A. Continuous Comprehensive Assessment (CCA)**<br>**• Theory – 25 Marks**<br>● Involvement and responses in class room transactions ● Home Assignments ● Oral presentation/ Viva/Quiz/Open book test ● Field study, Group discussion on a recent research or review article(<5 years) related to the course Any other method as may be required for specific course / student by the course faculty<br>**• Practical – 15 Marks**<br>Lab involvement and practical skills Records/Any other methods as may be required for specific course/ student by the course faculty.<br><br>**B. End Semester Evaluation (ESE)**<br>**• Theory – 50 Marks**<br>Assessment Methods – Written Examination<br>Duration of Examination – 1.50 Hrs<br>Pattern of examination for Theory – Non-MCQ<br>Different parts of written examination – Part - A , B , C<br>Answer Type:<br>◦ PART - A<br>◦ Short answer - (10 out of 12 ) – 10 × 1 = 10<br>◦ PART - B<br>◦ Short Essays - (6 out of 8 ) – 6 × 5 = 30<br>◦ PART - C<br>◦ Essays - (1 out of 2 ) – 1 × 10 = 10<br>**• Practical – 35 Marks**<br>Assessment Methods – Practical based Assessment Methods<br>Duration of Examination – 2.00 Hrs |



## References


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