**N N.M.S.S.VELLAICHAMY NADAR COLLEGE**

**DEPARTMENT OF MICROBIOLOGY AND BIOTECHNOLOGY**

 **SYLLABUS FOR THE AY 2023 – 2024**

**MICROBILOGY**

**SEMESTER – I**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PART** | **LIST OF COURSES** | **CODE** | **CREDIT** | **HOURS** |
| Part – I | Language – Tamil |  | 3 | 6 |
| Part – II | English |  | 3 | 4 |
| Part – III | Core – 1 Fundamentals of Microbiology and Microbial diversity |  | 4 | 5 |
| Core – 2 Lab in Fundamentals of Microbiology and microbial diversity |  | 4 | 5 |
| **Elective – (Generic/Discipline specific) EC-1 Any one** |  | 3 | 4 |
| 1. Basic and Clinical Biochemistry
 |  |  |  |
| 1. Introduction to Microbiology
 |  |  |  |
| Part – IV | **Skill Enhancement Course SEC – 1 (NME) Any one** |  | 2 | 2 |
| 1. Social and preventive medicine
 |  |  |  |
| 1. Mushroom cultivation process
 |  |  |  |
| Part – IV | **Foundation Course FC** |  | 2 | 2 |
| Microbial Taxonomy |  |  |  |
| **Ability Enhancement compulsory course (AECC) Soft skill – 1** |  | 2 | 2 |
|  | **Total** |  | **23** | **30** |

**SEMESTER – II**

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| --- | --- | --- | --- | --- |
| **PART** | **LIST OF COURSES** |  | **CREDIT** | **HOURS** |
| Part – I | Language – Tamil |  | 3 | 6 |
| Part – II | English |  | 3 | 4 |
| Part – III | Core – 3 Microbial physiology and metabolism |  | 4 | 5 |
| Core – 4 Lab in Microbial physiology and metabolism |  | 4 | 5 |
| **Elective – (Generic/Discipline specific) EC-2 Any one** |  | 3 | 4 |
| 1. Bioinstrumentation
 |  |  |  |
| 1. Applied Microbiology
 |  |  |  |
| Part – IV | **Skill Enhancement Course SEC – 2 (NME)** |  | 2 | 2 |
| Nutrition and Health hygiene |  |  |  |
| **Skill Enhancement Course SEC – 3 (NME)**  |  | 2 | 2 |
| Sericulture |  |  |  |
| **Ability Enhancement compulsory course (AECC) Soft skill – 2** |  | 2 | 2 |
|  | **Total** |  | **23** | **30** |

**SEMESTER – III**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PART** | **LIST OF COURSES** |  | **CREDIT** | **HOURS** |
| Part – I | Language – Tamil |  | 3 | 6 |
| Part – II | English |  | 3 | 4 |
| Part – III | Core – 5 Molecular biology and Microbial genetics |  | 4 | 5 |
| Core – 6 Lab in Molecular biology and Microbial genetics |  | 4 | 5 |
| **Elective – (Generic/Discipline specific) EC-3**  |  | 3 | 4 |
| Clinical Laboratory Technology |  |  |  |
| Part – IV | **Skill Enhancement Course SEC – 4 (Entrepreneurial based)** |  | 1 | 1 |
| Organic farming and biofertilizer technology |  |  |  |
| **Skill Enhancement Course SEC – 5**  |  | 2 | 2 |
| Aquaculture |  |  |  |
| **Ability Enhancement compulsory course (AECC) Soft skill – 3**Medical Coding - I |  | 2 | 2 |
| Environmental Studies (EVS) |  | 1 | 1 |
|  | **Total** |  | **23** | **30** |

**SEMESTER – IV**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PART** | **LIST OF COURSES** |  | **CREDIT** | **HOURS** |
| Part – I | Language – Tamil |  | 3 | 6 |
| Part – II | English |  | 3 | 4 |
| Part – III | Core – 7 Immunology and Immunotechnology |  | 4 | 5 |
| Core – 8 Lab in Immunology and Immunotechnology |  | 4 | 4 |
| **Elective – (Generic/Discipline specific) EC-4**  |  | 3 | 4 |
| Food processing technology |  |  |  |
| Part – IV | **Skill Enhancement Course SEC – 6**  |  | 2 | 2 |
| Vaccine technology |  |  |  |
| **Skill Enhancement Course SEC – 7** |  | 2 | 2 |
| Apiculture |  |  |  |
| **Ability Enhancement compulsory course (AECC) Soft skill – 4**Medical Coding - II |  | 2 | 2 |
| Environmental Studies (EVS) |  | 1 | 1 |
|  | **Total** |  | **24** | **30** |

**SEMESTER – V**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PART** | **LIST OF COURSES** |  | **CREDIT** | **HOURS** |
| Part – III | Core – 9 Bacteriology and Mycology |  | 4 | 5 |
| Core – 10 Virology and Parasitology |  | 4 | 5 |
| Core – 11 Lab in Medical Microbial Technology |  | 4 | 5 |
| Core Course / Project – 12 |  | 4 | 4 |
| **Elective – (Generic/Discipline specific) EC-5**  |  | 3 | 5 |
| Recombinant DNA technology |  |  |  |
| **Elective – (Generic/Discipline specific) EC-6** |  | 3 | 5 |
| Biosafety and Bioethics |  |  |  |
| Part IV | Value Education |  | 2 | 2 |
| Internship / Industrial Training |  | 2 |  |
| **Total** |  | **26** | **31** |

**SEMESTER – VI**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PART** | **LIST OF COURSES** |  | **CREDIT** | **HOURS** |
| Part – III | Core – 13 Environmental and Agricultural Microbiology |  | 4 | 6 |
| Core – 14 Food, Dairy and Probiotic Microbiology |  | 4 | 6 |
| Core – 15 Lab in Food and Agricultural Microbiology |  | 4 | 6 |
| **Elective – (Generic/Discipline specific) EC-7**  |  | 3 | 5 |
| Pharmaceutical Microbiology |  |  |  |
| **Elective – (Generic/Discipline specific) EC-8** |  | 3 | 5 |
| Entrepreneurship and Bio business |  |  |  |
| Part IV | Extension Activity |  | 1 | - |
| **Professional Competency Skill (Competitive examinations)**Microbial Quality Control and Testing |  | 2 | 2 |
|  | **Total** |  | **21** | **30** |
|  | **Overall Total** |  | **140** |  |

 **SEMESTER – I**

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| Title of the Course | **FUNDAMENTALS OF MICRBIOLOGY AND MICROBIAL DIVERSITY** |
|  |  |
| **Category** | Core –I | Year | I | **Credits** | 4 | **Course Code** | **CCI** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 5 | - | -- | 5 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Learn the fundamental principles about different aspects of Microbiology including recent developments in the area.  |
| **LO2** | Describe the structural organization, morphology and reproduction of microbes. |
| **LO3** | Explain the methods of cultivation of microbes and measurement of growth. |
| **LO4** | Understand the microscopy and other basic laboratory techniques – culturing, disinfection and sterilization in Microbiology. |
| **LO5** | Compare and contrast the different methods of sterilization. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | History and Evolution of Microbiology, Classification– Three kingdom, five kingdom, six kingdom and eight kingdom. Microbial biodiversity: Introduction to microbial biodiversity- ecological niche. Basic concepts of Eubacteria, Archaebacteria and Eucarya. Conservation of Biodiversity.  |  15 |
| **II** | General characteristics of cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Structure of fungi (Mold and Yeast), Structure of microalgae.  |  15 |
| **III** | Bacterial culture media and pure culture techniques. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.  |  15 |
| **IV** | Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM, Confocal microscopy, and Atomic Force Microscopy. Stains and staining methods.  |  15 |
| **V** | Sterilization–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents. |  15 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Study the historical events that led to the discoveries and inventions and understand the Classification of Microorganisms. |
| **CO2** | Gain Knowledge of detailed structure and functions of prokaryotic cell organelles. |
| **CO3** | Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms. |
| **CO4** | Explain the principles and working mechanism of different microscopes/Microscope, their function and scope of application. |
| **CO5** | Understand the concept of asepsis and modes of sterilization and disinfectants. |

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| **Text Books**  |
| 1 | Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition.,McGraw –Hill, New York. |
| 2 | Willey J., Sherwood L., and Woolverton C. J., (2017). Prescott’s Microbiology. 10thEdition., McGraw-Hill International edition. |
| 3 | Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th Edition., A La Carte Pearson. |
| 4 | Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th Edition., McGraw Hill Inc.New York. |
| 5 | Boyd, R.F. (1998). General Microbiology,2nd Edition., Times Mirror, Mosby CollegePublishing, St Louis. |
| **References Books** |
| 1 | Jeffrey C. Pommerville., Alcamo’s Fundamentals of Microbiology (9th Edition). Jones &Bartlett learning 2010. |
| 2 | Stanier R.Y, Ingraham J. L., Wheelis M. L., and Painter R. R. (2010). General Microbiology, 5th Edition., MacMillan Press Ltd |
| 3 | Tortora, G.J., Funke, B.R. and, Case, C.L (2013). Microbiology-An Introduction, 11th Edition., Benjamin Cummings. |
| 4 | Nester E., Anderson D., Roberts C. E., and Nester M. (2006). Microbiology-A Human Perspective, 5th Edition., McGraw Hill Publications. |
| 5 | Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). Brock - Biology of Microorganisms, 13th Edition Benjamin-Cummings Pub Co. |
| **Web Resources** |
| 1 | https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology |
| 2 | <https://www.keyence.com/ss/products/microscope/bzx/study/principle/structure.jsp> |
| 3 | https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/# |
| 4 | [https://bio.libretexts.org/@go/page/9188](https://bio.libretexts.org/%40go/page/9188) |
| 5 | https://courses.lumenlearning.com/boundlessmicrobiology/chapter/microbial-nutrition/ |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 2 | 2 | 1 | 1 |
| **CO2** | 3 | 3 | 2 | 2 | 1 |
| **CO3** | 3 | 3 | 3 | 2 | 1 |
| **CO4** | 3 | 3 | 3 | 3 | 1 |
| **CO5** | 3 | 3 | 3 | 3 | 3 |

**3- Strong 2- Medium 1- Low**

**Mapping with Programme Specific Outcomes:**

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| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 3 | 2 | 3 | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 3 |
| **CO4** | 3 | 3 | 3 | 3 | 2 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |
| **Weightage** | 15 | 15 | 13 | 13 | 13 |
| **Weighted percentage of Course Contribution to Pos** | 69/75=92% |  |  |  |  |

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| Title of the Course |  **FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY** |
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| **Category** | **Core –II Practical** | Year | I | **Credits** | 4 | **Course Code** | **CCII** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| - | - | 5 | 5 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Acquire knowledge on Cleaning of glass wares, GLP and sterilization.  |
| **LO2** | Gain knowledge on media preparation and cultural characteristics. |
| **LO3** | Learn the pure culture technique |
| **LO4** | Learn the microscopic techniques and staining methods. |
| **LO5** | Acquire knowledge on stain and staining methods  |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Cleaning of glass wares, Microbiological good laboratory practice and safety. Sterilization and assessment of sterility– Autoclave, hot air oven, and membrane filtration.  |  15 |
| **II** | Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates. |  15 |
| **III** | Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation- quality control of media, growth supporting properties, sterility check of media.Pure culture techniques: streak plate, pour plate, decimal dilution. |  15 |
| **IV** | Culture characteristics of microorganisms: growth on different media, growth characteristics, and description. Demonstration of pigment production.Microscopy: light microscopy and bright field microscopy. |  15 |
| **V** | Staining techniques: smear preparation, simple staining, Gram’s staining and endospore staining.Study on Microbial Diversity using Hay Infusion Broth-Wet mount to show different types of microbes, hanging drop. |  15 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Practice sterilization methods; learn to prepare media and their quality control.  |
| **CO2** | Learn streak plate, pour plate and serial dilution and pigment production of microbes. |
| **CO3** | Understand Microscopy methods, different Staining techniques and motility test. |
| **CO4** | Observeculture characteristics of microorganisms. |
| **CO5** | Study on Microbial Diversity using Hay Infusion Broth-Wet mount |

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| **Text Books**  |
| 1 | James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996. |
| 2 | Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications. |
| 3 | Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications. |
| 4 | Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi. |
| 5 | R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing. |
| **References Books** |
| 1 | Atlas.R (1997). Principles of Microbiology, 2nd Edition, Wm.C.Brown publishers.  |
| 2 | Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1st Edition). Elsevier India |
| 3 | Talib VH (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS |
| 4 | Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.  |
| 5 | Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications. |
| **Web Resources** |
| 1 | http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403. |
| 2 | <https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635> |
| 3 | https://www.grsmu.by/files/file/university/cafedry//files/essential\_microbiology.pdf |
| 4 | https://microbiologyinfo.com/top-and-best-microbiology-books/ |
| 5 | <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology> |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
| **CO1** |  |  |  | 2 |  |  | 1 | 2 | 1 |  | 2 |
| **CO2** |  |  |  | 3 |  |  | 1 | 1 | 1 |  |  |
| **CO3** |  |  |  | 3 |  |  | 2 | 2 | 1 |  | 2 |
| **CO4** |  |  |  | 3 |  |  | 2 | 1 | 1 |  |  |
| **CO5** |  |  |  | 3 |  |  | 2 | 1 | 1 |  |  |

 **3- Strong 2- Medium 1- Low**

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| Title of the Course | **BASIC AND CLINICAL BIOCHEMISTRY** |
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| **Category** | **Elective-I** | Year | I | **Credits** | 3 | **Course Code** | **EC-I** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 4 | - | -- | 4 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Attain thorough knowledge on carbohydrates and lipids, their characteristic properties and organization in carrying out all the living functions which constitute the life. |
| **LO2** | Explain the biological activity of amino acids and proteins. |
| **LO3** | Identify the metabolic errors in enzymes of carbohydrates and lipids. |
| **LO4** | Describe the disorders in amino acid metabolism. |
| **LO5** | Interpret the consequences, biochemical, clinical features, diagnosis and treatment of metabolic diseases of day today life. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance. | 12 |
| **II** | Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance. | 12 |
| **III** | Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance. Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hypertriglyceridemia, sphingolipidosis. | 12 |
| **IV** | Disorders of Metabolism: Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias. | 12 |
| **V** | Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. | 12 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Explain the structure, classification , biochemical functions and significance of carbohydrates and lipids |
| **CO2** | Differentiate essential and non-essential amino acids, biologically important modified amino acids and their functions, Illustrate the role, classification of Proteins and recognize the structural level organization of proteins, its functions and denaturation. |
| **CO3** | Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism. |
| **CO4** | Discuss and evaluate the pathology of aminoacid metabolic disorders. |
| **CO5** | Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis. |

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| **Text Books**  |
| 1 | Satyanarayana, U. and Chakrapani, U(2014).Biochemistry,4th Edition, Made Simple Publisher. |
| 2 | Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7th Edition, S Chand Company. |
| 3 | AmbikaShanmugam’s (2016). Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd. |
| 4 | Vasudevan. D.M.Sreekumari.S, Kannan Vaidyanathan (2019). Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers |
| 5 | Jeremy M. Berg,LubertStryer, John L. Tymoczko, Gregory J. Gatto (2015). Biochemistry, 8th edition. WH Freeman publisher. |
| **References Books** |
| 1 | AmitKessel&Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2nd Edition, Chapman and Hall. |
| 2 | David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry, 7th Edition W.H. Freeman and Co., NY. |
| 3 | LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9th Edition ,W.H.Freeman& Co. New York. |
| 4. | Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley. |
| 5.  | Joy PP, Surya S. and AswathyC (2015). Laboratory Manual of Biochemistry, Edition 1.,Publisher:Kerala agricultural university.  |
|  |  |
| **Web Resources** |
| 1 | https://www.abebooks.com › plp |
| 2 | <https://kau.in/document/laboratory-manual-biochemistry> |
| 3 | <https://metacyc.org> |
| 4 | <https://www.medicalnewstoday.com> |
| 5 | <https://journals.indexcopernicus.com> |

 **Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** | 2 |  |  |  |  |  |  |  |  |  |
| **CO 2** | 2 |  |  |  |  |  |  |  |  |  |
| **CO 3** |  |  |  | 3 | 3 | 3 |  |  |  |  |
| **CO 4** |  |  |  | 3 | 3 | 3 |  |  |  |  |
| **CO 5** |  |  |  |  | 3 | 3 |  |  | 3 |  |

3 – Strong, 2 – Medium , 1 - Low

**Mapping with Programme Specific Outcomes:**

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| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| Title of the Course | **Introduction to Microbiology**  |
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| **Category** | Elective –I | Year | I | **Credits** | 3 | **Course Code** | **EC1** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 4 | - | -- | 4 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Learn the ultra-structure of prokaryotes and eukaryotes.  |
| **LO2** | Describe the principle, working mechanism and applications of instruments. |
| **LO3** | Explain the methods of food spoilage and control measures. |
| **LO4** | Identify the causative organisms of certain diseases. |
| **LO5** | Interpret the chemotherapy, types of vaccines. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Ultra structure of prokaryotic (Bacteria) and eukaryotic (Plant and Animal) cell. Difference between prokaryotic and eukaryotic cell. |  12 |
| **II** | Working mechanism and applications of Bright field microscope, Laminar air flow, Incubator and Centrifuge. |  12 |
| **III** | Microbial growth and Food Spoilage – Meat and Milk - Controlling of food spoilage – High temperature, Drying and Chemical preservation. |  12 |
| **IV** | Causative Organisms – Pathogenesis, prevention and treatment of disease – Typhoid fever, AIDS and Malaria. |  12 |
| **V** | Chemotherapy - Penicillin, Vaccines – Live attenuated vaccine (Oral polio vaccine) – Immunization schedule. |  12 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Understand the characteristic of bacteria, plant and animal cell, cell organelles, cell composition and difference between prokaryotic and eukaryotic cell. |
| **CO2** | Demonstrate theory and practical skills in microscopy techniques. Working principle for laminar air flow, incubator. |
| **CO3** | To assess the role of microorganisms in meat and milk product and how to protect against microbes. |
| **CO4** | Gain a good understanding of pathogenesis, prevention and treatment for bacteria, fungi and parasites. |
| **CO5** | Elucidate the reason for immunization and aware of vaccination schedule. |

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| **Text Books**  |
| 1 | 1. PelczarJ.R.,Chan E.C.S., and Krieg R., Microbiology,5th Edition, Tata McGraw-Hill publishing company Limited, Delhi, 2004.
 |
| 2 | 1. Dubey R.C., Text book of Biotechnology, S.Chand publishers, New Delhi
 |
| **References Books** |
| 1 | Prescott L.M., Harley J.P., and Klein B.A., Microbiology,6th Edition ,McGraw-Hill Companies, New York,1993. |
| 2 | Bernard R., Click and Jack J, Pasternack. Molecular Biotechnology, American society for microbiology, London 2003. BBN. |
| **Web Resources** |
| 1 | <http://www.biologydiscussion.com/micro-biology/morphology-and-ultrastructure-of-a-bacterial-cell-with-diagram/17901> |
| 2 | <http://www.yourarticlelibrary.com/micro-biology/working-principle-and-parts-of-a-compound-microscope-with-diagrams/26509> |
| 3 | <http://www.simplynotes.in/food-biotechnology/milk-spoilagetypes-of-spoilage/> |
| 4 | <https://www.medicalnewstoday.com/articles/156859>, <http://www.preservearticles.com/health/what-is-aids/685> |
| 5 | <https://www.vaccines.gov/basics/types>, <https://communitymedicine4asses.com/2018/12/16/national-immunization-schedule-2018-india/> |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  **POs****COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 1 | 1 | 2 | 1 | 1 |
| **CO2** | 2 | 1 | 1 | 2 | 3 |
| **CO3** | 3 | 3 | 3 | 2 | 2 |
| **CO4** | 3 | 3 | 1 | 2 | 3 |
| **CO5** | 3 | 3 | 1 | 3 | 3 |

**3- Strong 2- Medium 1- Low**

 **Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| --- | --- |
| Title of the Course | **Social and Preventive medicine** |
|  |  |
| **Category** | **SEC-I****NME** | Year | I | **Credits** | 2 | **Course Code** | **SECI** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 2 | - | -- | 2 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Identify the health information system |
| **LO2** | Associate various factors with health management system |
| **LO3** | Choose the appropriate health care services |
| **LO4** | Appraise the role of preventive medicine in community setting |
| **LO5** | Recommend the usage of alternate medicine during outbreaks  |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Introduction to social medicine:History of social medicine-concepts of health and disease-social determinants of health and disease-Health and quality of life-Health information system- measures of population health-health policies. | 6  |
| **II** | Health management:Applications of behavioral sciences and psychology in health management- nutritional programs for health management-water and sanitation in human health-national programs for communicable and non-communicable diseases- environmental and occupational hazards and their control.  | 6  |
| **III** | Health care and services:Health care of the community-information, education, communication and training in health-maternal & child health-school health services- Geriatrics-care and welfare of the aged-mental health-health services through general practitioners. | 6  |
| **IV** | Preventive medicine: Introduction- role of preventive medicine- levels of prevention-Risk assessment in communities and vulnerable population –surveillance, monitoring and reporting of disease outbreaks - forecasting and control measures in community setting – early detection methods. | 6  |
| **V** | Prevention through alternate medicine:Unani, Ayurveda, Homeopathy, Naturopathy systems in epidemic and pandemic outbreaks. International health regulations. Infectious disease outbreak case studies and precautionary response during SARS and MERS coronavirus, Ebola and novel SARS-COV2 outbreaks.  | 6  |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Describe the concepts of health and disease and their social determinants |
| **CO2** | Summarize the health management system |
| **CO3** | Know about the various health care services |
| **CO4** | Outline the goals of preventive medicine |
| **CO5** | Gain knowledge about alternate medicine |

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| **Text Books**  |
| 1. | Park.K (2021). Textbook of preventive and social medicine, 26th  edition. Banarsidas Bhanot publishers. |
| 2. | Mahajan& Gupta (2013). Text book of preventive and social medicine, 4th edition. Jaypeebrothers medical publishers.  |
| 3.  | Chun-Su Yuan, Eric J. Bieber, Brent Bauer (2006). Textbook of Complementary and Alternative Medicine. Second Edition. Routledge publishers. |
| 4. | Vivek Jain (2020). Review of Preventive and Social Medicine: Including Biostatics. 12th edition, Jaypee Brothers Medical Publishers. |
| 5. | Lal Adarsh Pankaj Sunder (2011). Textbook of Community Medicine: Preventive and Social Medicine, CBS publisher. |
| **References Books** |
| 1 | Howard Waitzkin, Alina Pérez, Matt Anderson (2021). Social Medicine and the coming Transformation. First Edition. Routledge publishers. |
| 2 | GN Prabhakara (2010). Short Textbook of Preventive and Social Medicine. Second Edition. Jaypee publishers. |
| 3 | Jerry M. Suls, Karina W. Davidson, Robert M. Kaplan (2010).Handbook of Health Psychology and BehavioralMedicine.Guilford Press. |
| 4 | Marie Eloïse Muller, Marie Muller, MarthieBezuidenhout, KarienJooste (2006).Health Care Service Management. Juta and Company Ltd. |
| 5 | Geoffrey Rose (2008).Rose's Strategy of Preventive Medicine: The Complete.OUP Oxford. |
|  |  |
| **Web Resources** |
| 1 | <https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articles-ppts-list.php> |
| 2 | https://www.teacheron.com/online-md\_preventive\_and\_social\_medicine-tutors |
| 3 | <https://www.futurelearn.com> |
| 4 | <https://www.healthcare-management-degree.net> |
| 5 | https://www.conestogac.on.health-care-administration-and-service-management |

 **Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** | 3 |  |  |  | 3 | 3 |  |  |  |  |
| **CO 2** | 3 | 3 |  | 2 | 3 | 3 |  |  | 2 |  |
| **CO 3** |  |  |  | 2 | 3 | 3 |  |  |  |  |
| **CO 4** | 3 |  |  | 3 | 3 | 2 |  |  |  |  |
| **CO 5** | 3 |  |  |  | 3 | 3 |  |  |  |  |

3 – Strong, 2 – Medium , 1 – Low

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 |  |  | 3 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 |
| **CO3** |  |  | 2 | 3 | 3 |
| **CO4** | 3 |  | 3 | 3 | 2 |
| **CO5** | 3 |  |  | 3 | 3 |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| --- | --- |
| Title of the Course |  **Mushroom Cultivation Process** |
|  |  |
| **Category** | **SEC – I****NME** | Year | I | **Credits** | 2 | **Course Code** | **SEC I** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 2 | - | -- | 2 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Identify the morphology and types of mushroom. |
| **LO2** | Associate various types of mushroom cultivation. |
| **LO3** | Choose the appropriate mushroom production. |
| **LO4** | Appraise the role of large scale mushroom production and spawn production. |
| **LO5** | Recommend the control measures for mushroom diseases. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Introduction: Morphology, Types of Mushroom, identification of edible and poisonous mushroom, Nutritive values, life cycle of common edible mushrooms. | 6 |
| **II** | Mushroom cultivation, prospects and scope of Mushroom cultivation in small scale. | 6 |
| **III** | Life cycle of Pleurotus spp and Agaricus spp | 6 |
| **IV** | Spawn production, growth media, spawn running and harvesting of mushrooms and marketing | 6 |
| **V** | Diseases and post-harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases. | 6 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Describe the morphology and types of mushrooms. |
| **CO2** | Summarize the scope of mushroom. |
| **CO3** | Know about the life cycle of muhroom |
| **CO4** | Outline the goals of spawn production, growth media, harvesting, marketing. |
| **CO5** | Gain knowledge about diseases and post-harvest technology. |

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| **Text Books**  |
|  | Changs .T and Hayanes W.A.(Ed) (1978), Biology and cultivation of edible mushrooms. Academic press.N.Y. |
| **References Books** |
| 1. |  Handbook of Mushroom Cultivation. 1999. TNAU publication. |
| 2. |  Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. (1991).  |
| 3. | Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford & IBH publishing co., Pvt., Ltd., New Delhi. 5. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17. |
| 4. |  Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Co. Ltd., No. 88, Mysore Road, Bangalore - 560018. |
| 5. | Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi |
|  |  |
| **Web Resources** |
| 1. <https://www.agricultureinindia.net/cultivation/mushroom-cultivation/mushroom-cultivation-introduction-classification-steps-pests-and-diseases-agriculture/20733>
2. <https://www.gurunanakcollege.edu.in/files/science/mushroom-cultivation.pdf>
 |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** | 3 |  |  |  | 3 | 3 |  |  |  |  |
| **CO 2** | 3 | 3 |  | 2 | 3 | 3 |  |  | 2 |  |
| **CO 3** |  |  |  | 2 | 3 | 3 |  |  |  |  |
| **CO 4** | 3 |  |  | 3 | 3 | 2 |  |  |  |  |
| **CO 5** | 3 |  |  |  | 3 | 3 |  |  |  |  |

3 – Strong, 2 – Medium , 1 – Low

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 |  |  | 3 | 3 |
| **CO2** | 3 | 3 | 2 | 3 | 3 |
| **CO3** |  |  | 2 | 3 | 3 |
| **CO4** | 3 |  | 3 | 3 | 2 |
| **CO5** | 3 |  |  | 3 | 3 |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| --- | --- |
| Title of the Course |  **MICROBIAL TAXONOMY** |
|  |  |
| **Category** | **FC** | Year | I | **Credits** | 2 | **Course Code** | **FC** |
| **Semester** | I |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 2 | - | -- | 2 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | To understand the theory and practice of describing, naming and the different taxonomic  groups of Microorganisms. |
| **LO2** | To learn about the Bacterial characteristics and classification.  |
| **LO3** | To acquire knowledge on Classification and understanding the importance of prokaryotic  organisms. |
| **LO4** | To Gain the knowledge on virus and bacteriophage. |
| **LO5** | To impart knowledge on economic importance of algae and fungi. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Taxonomy -hierarchy of taxonomy - Taxonomic Ranks - Binomial nomenclature –Bergey’s Classification systems – Numerical taxonomy.  | 6 |
| **II** | Major characteristics used in taxonomy- Morphological, Physiological and Molecular characteristics. Haeckel’s Three kingdom and Whittaker Five Kingdom Classification. | 6 |
| **III** | Bacteria – characteristics, Difference between Archeabacteria and Eubacteria. Over view of classification and economic importance.  | 6 |
| **IV** | Virus-General structure, characteristics and classification of animal virus, plant virus and bacteriophage.  | 6 |
| **V** | Algae - characteristics, classification (Fritz) and economic importance. Fungi - characteristics, classification (Alexopolus) and economic importance. | 6 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Exert the concept of classification systems of biological organisms and rules of binomial nomenclature |
| **CO2** | Impart knowledge on major characteristics and classification of microorganisms. |
| **CO3** | Describe the knowledge on the General characters, classification and economic importance of bacteria. |
| **CO4** | Study the structure, characteristics and classification of virus.  |
| **CO5** | Deliver knowledge on characteristics, classification and economic importance of algae and fungi. |

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| **Text Books**  |
|  | Prescott L.M., Harley J.P., and Klein B.A., Microbiology, 6th edition, McGraw- Hill Companies, New York |
|  | Schlegel G., General microbiology, 7th Edition, Cambridge University press, UK |
| **References Books** |
|  | Jordan E.L., and Verma P.S., Invertebrate Zoology, S.Chand and company Pvt Ltd, Ram nagar, New Delhi, 2013. |
|  | Jordan E.L., and Verma P.S., Chordate Zoology, S.Chand and company Pvt Ltd, Ram nagar, New Delhi, 2013 |
|  | Vashishta B.R., Botany for Degree Students- Algae, S.Chand and company Pvt Ltd, Ram nagar, New Delhi, 1973 |
|  | Vashishta B.R., Botany for Degree Students- Fungi, S.Chand and company Pvt Ltd, Ram nagar, New Delhi, 1973. |
| **Web Resources** |
| 1 |  <https://www.britannica.com/science/taxonomy> |
| 2 | <https://en.wikipedia.org/wiki/Virus_classification> |
| 3 | <http://www.biologydiscussion.com/fungi/classification-fungi/classification-of-fungi-with-diagram/69720> |
| 4 | <https://www.toppr.com/guides/biology/diversity-in-living-organisms/animal-kingdom/> |
| 5 | <https://www.toppr.com/guides/biology/diversity-in-living-organisms/plant-kingdom/> |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** | **3** | **3** |  | **2** | **3** |  |  |  |  |  |
| **CO 2** | **2** |  | **2** | **2** |  |  |  |  |  |  |
| **CO 3** |  | **2** | **1** | **3** | **3** |  |  |  |  |  |
| **CO 4** | **1** | **3** | **3** | **1** | **2** |  |  |  |  |  |
| **CO 5** | **2** | **2** | **3** | **3** | **3** |  |  |  |  |  |

3 – Strong, 2 – Medium , 1 – Low

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

**SEMESTER – II**

|  |  |
| --- | --- |
| Title of the Course | **MICROBIAL PHYSIOLOGY AND METABOLISM** |
|  |  |
| **Category** | **Core – III** | Year | I | **Credits** | 4 | **Course Code** | **CC- III** |
| **Semester** | II |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 5 | - | -- | 5 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Study the basic principles of microbial growth. |
| **LO2** | Understand the basic concepts of aerobic and anaerobic metabolic pathways. |
| **LO3** | Analyze the role of individual components in overall cell function. |
| **LO4** | Provide information on sources of energy and its utilization by microorganisms. |
| **LO5** | Study the different types of metabolic strategies. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Physiology of microbial growth: Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass,and cell count). Control of microbial growth. | 15 |
| **II** | Nutrition requirements - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen, Iron oxidizing Bacteria), Chemoorganotrophs. Nutrition transport mechanisms – Passive diffusion and Active transport. Factors affecting microbial growth. | 15 |
| **III** | An overview of Metabolism - Embden Meyerhof Pathway, Entner-Doudoroff Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation-Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation, Butanediol Fermentation | 15 |
| **IV** | Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle. | 15 |
| **V** | Bacterial reproduction - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation. Fungi asexual and sexual reproduction, Microalgae reproduction. Asexual and sexual reproduction of protozoa. | 15 |
| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Describe microorganisms based on nutrition. |
| **CO2** | Know the concept of microbial growth and identify the factors affecting bacterial growth. |
| **CO3** | Explain the methods of nutrient uptake. |
| **CO4** | Describe anaerobic and aerobic energy production. |
| **CO5** | Elaborate on the process of bacterial photosynthesis and reproduction |

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| **Text Books**  |
| 1 | Schlegal, H.G. (1993). General Microbiology.,7th Edition, Press syndicate of the University of Cambridge. |
| 2 | RajapandianK.(2010). Microbial Physiology, Chennai: PBS Book Enterprises India. |
| 3 | MeenaKumari. S. Microbial Physiology, Chennai 1st Edition MJP Publishers 2006. |
| 4 | Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co |
| 5 | S. Ram Reddy, S.M. Reddy (2008). Microbial Physiology. Anmol Publications Pvt Ltd |
| **References Books** |
| 1 | Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49. |
| 2 | Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge |
| 3 | Daniel R. Caldwell. (1995). Microbial Physiology & Metabolism Wm.C. Brown Communications, Inc. USA. |
| 4 | Moat, A.G and J.W Foaster (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications. |
| 5 | BhanuShrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication. |
| **Web Resources** |
| 1 | https://sites.google.com/site/microbial physiologyoddsem/teaching-contents |
| 2 | <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition> |
| 3 | <https://onlinecourses.swayam2.ac.in/cec20_bt14/preview> |
| 4 | <http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf> |
| 5 | <https://www..frontiersin.org.microbial-physiology-and-metabolism> |

**Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** |  |  |  |  |  | 2 |  |  | 2 |  |
| **CO 2** |  |  |  |  |  | 2 | 1 |  | 2 |  |
| **CO 3** |  |  |  |  |  | 2 |  |  | 2 |  |
| **CO 4** |  |  |  |  |  | 2 |  |  | 2 |  |
| **CO 5** |  |  |  |  |  | 2 |  |  | 2 |  |

3 – Strong, 2 – Medium , 1 - Low

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| --- | --- |
| Title of the Course | **MICROBIAL PHYSIOLOGY AND METABOLISM** |
|  |  |
| **Category** | **Core –IV Practical** | Year | I | **Credits** | 4 | **Course Code** | **CC - IV** |
| **Semester** | II |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| - | - |  5 | 5 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Understand the principles of motility test.  |
| **LO2** | Understand the basic concepts of staining methods. |
| **LO3** | Learn the bacterial count using different methods and anaerobic culture. |
| **LO4** | Study the morphological demonstration of microorganisms and identification. |
| **LO5** | Study the biochemical identification of the bacteria. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Motility demonstration: hanging drop, wet mount preparation, semi-solid agar, Craigie’s tube method. Staining techniques: Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining | **15** |
| **II** | Direct counts – Direct cell count (Petroff-Hausser counting chamber), Turbidometry. Viable count - pour plate, spread plate. Bacterial growth curve.  | **15** |
| **III** | Anaerobic culture methods. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. | **15** |
| **IV** | Morphological variations in algae, fungi and protozoa. Micrometry: Demonstration of the size of yeast, fungal filaments and protozoa. | **15** |
| **V** | Methods of bacterial identification- morphological, physiological, and biochemical methods - IMViC test, H2S, TSI, Oxidase, catalase, urease test, and Carbohydrate fermentation test.Maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture. | **15** |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Describe hanging drop, wet mount preparation, semi-solid agar, Craigie’s tube method.  |
| **CO2** | Demonstrate Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining. |
| **CO3** | Explain antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. |
| **CO4** | Describe demonstration of the size of yeast, fungal filaments and protozoa. |
| **CO5** | Elaborate on the bacterial identification- morphological, physiological, and biochemical methods. |

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| **Text Books**  |
| 1 | James G Cappucino and N. Sherman MB (1996). A lab manual Benjamin Cummins, New York . |
| 2 | Kannan. N (1996).Laboratory manual in General Microbiology. Palani Publications |
| 3 | Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications. |
| 4 | Gunasekaran. P (2007). Laboratory manual in Microbiology. New age international publisher. |
| **References Books** |  |
| 1 | DavidWhite., James Drummond., Clay Fuqua (2012) Physiology and Biochemistry of Prokaryotes. 4th Ed. Oxford University Press, New York. |
| 2 | Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49. |
| 3 | Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge. |
| 4 | Dawes, I.W and Sutherland L.W (1992). Microbial Physiology (2nd edition), Oxford Blackwell Scientific Publications. |
| 5 | Moat, A.G and J.W Foaster, (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications. |
| **Web Resources** |
| 1 | https://sites.google.com/site/microbial physiologyoddsem/teaching-contents |
| 2 | <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition> |
| 3 | <https://onlinecourses.swayam2.ac.in/cec20_bt14/preview> |
| 4 | https://www.studocu.com/microbial-physiology-practicals |
| 5 | https://www.agr.hokudai.ac.jp/microbial-physiology |

 **Mapping with Programme Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** |  |  |  |  |  | M | L | M | L |  | M |
| **CO 2** |  |  |  |  |  | M | M | L | M |  | L |
| **CO 3** |  |  |  |  |  | L | M | M | L |  | M |
| **CO 4** |  |  |  |  |  | L | M | M | M |  | M |
| **CO 5** |  |  |  |  |  | M | M | M | M |  | M |

3 – Strong, 2 – Medium , 1 - Low

 **Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| Title of the Course | **BIOINSTRUMENTATION** |
|  |  |
| **Category** | **Elective - II** | Year | I | **Credits** | 3 | **Course Code** | **EC - II** |
| **Semester** | II |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 4 | - | -- | 4 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Practice, experiment with and apply the basic instruments in the laboratory. |
| **LO2** | Predict the functionality of Beer – Lambert’s law in identifying and quantifying a biomolecule.  |
| **LO3** | Employ the separation techniques for separating biomolecules based on chromatography and electrophoretic techniques. |
| **LO4** | Understand the clinical important isotopes and detection of isotopes. |
| **LO5** | Employ the separation techniques for separating biomolecules based on centrifugal force by centrifugation. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | pH – Definition – pH meter. Measurement of pH and calibration of pH meter - Buffers – Preparation of Buffers. Microscopy: Principle and applications of Compound, Bright field, Phase contrast and Fluorescence Microscope. | 12 |
| **II** | Spectra – Absorption and Emission Spectra – Beer Lambert’s law – Colorimeter, UV-Visible Spectrophotometer. Mass spectroscopy - Atomic absorption spectrometer (AAS) - Nuclear magnetic resonance spectrometer (NMR). | 12 |
| **III** | Chromatography - Principles – Paper Chromatography, TLC, Gel filtration, Ion-Exchange, Affinity Chromatography Gas Liquid Chromatography and HPLC. Electrophoresis: Principle, Paper Electrophoresis – Cellulose Acetate Electrophoresis - Agarose Gel Electrophoresis – SDS- PAGE and Iso-electric focusing. | 12 |
| **IV** | Radioactivity – Isotopes – Clinically important isotopes – Measurement of Radioactivity – GM Counters, Scintillation Counters – Autoradiography – Applications. SOPs for Radioactive materials. | 12 |
| **V** | Centrifugation – Principles - RCF, Sedimentation concept - - Different types of centrifuge – Types of rotors – Centrifugation types: Differential and Density gradient centrifugation – Ultra Centrifuge. | 12 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Learn about handling and uses of pH meter and microscope |
| **CO2** | Spectroscopy can clarify its principle, types and its benefits  |
| **CO3** | Learn more about chromatography and electrophoresis techniques |
| **CO4** | Understanding about radio isotopes and its applications in medicine  |
| **CO5** | Get a solution about the types of centrifuge and how to use to sedimentation of mixtures. |

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| **Text Books**  |
| 1. | Upadhyay and UpadhyayNath. (2009). “Biophysical Chemistry”, Principles and Techniques. Himalaya Publishing House. |
| 2. | L.Veerakumari, (2006) “Bioinstrumentation” MJP publishers , Kindle Edition. |
| 3. | SkoogD.A.F.James Holler and Stanky,R.Crouch, (2007) “Instrumental Methods of Analysis” Cengage Learning. |
| 4. | Palanivelu P, 2000. Analytical Biochemistry & Separation Techniques, 4th edition, Twenty first century publications. |
| 5. | Prakash M, 2009. Understanding Bioinstrumentation, 1st edition, Discovery Publishing House Pvt Ltd |
| **References Books** |
| 1. | Keith Wilson,John Walker,(2010).Principles and techniques of Biochemistry and Molecular Biology”(7th edition).Cambridge University Press. |
| 2. | David L.Nelson, Michael M Cox.Lehninger(2008).”Principles of Biochemistry”,Fifth edition W.H.Freeman,Newyork. |
| 3. | Khandpur R S, 2014. Handbook of Biomedical Instrumentation, 3rd edition, McGraw Hill Education (India). |
| 4. | L.A Geddes and L.E.Baker (2008) “Principles of Applied Biomedical Instrumentation”WileyIndia Third Edition. |
| 5. | Sharma B K, 2005. Instrumental Methods of Chemical Analysis, 24th Edition, GOEL Publishing House. |
| **Web Resources** |
| Unit-I | <https://microbeonline.com/ph-meter-parts-principle-and-applications/><https://www.britannica.com/technology/microscope> |
| Unit-II | https://www.vedantu.com/physics/spectroscopy#:~:text=be%20updated%20soon)-,Principle%20of%20Spectroscopy,by%20the%20sample%20or%20object. |
| Unit-III | <https://microbenotes.com/chromatography-principle-types-and-applications/>https://microbeonline.com/electrophoresis-principles-types-and-uses/ |
| Unit-IV | <https://www.britannica.com/story/how-radioactive-isotopes-are-used-in-medicine> |
| Unit-V | https://microbenotes.com/centrifugation-principle-types-and-applications/ |

**MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOME**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PSO1** | **PSO2** | **PSO3** |
| **CLO1** | **3** | **3** | **3** |  **3** |  **3** |  **3** |  **3** |  **3** |  **3** |
| **CLO2** | **3** | **3** | **3** |  **3** |  **3** |  **3** |  **3** |  **3** |  **3** |
| **CLO3** | **3** | **3** | **3** |  **3** |  **2** |  **3** |  **3** |  **3** |  **3** |
| **CLO4** | **3** | **3** | **3** |  **2** |  **3** |  **2** |  **3** |  **3** |  **2** |
| **CLO5** | **3** | **3** | **3** |  **3** |  **3** |  **3** |  **3** |  **2** |  **3** |
| **TOTAL** |  **15** | **15** | **15** | **14** | **14** | **14** | **15** | **14** | **14** |

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| --- | --- |
| Title of the Course | **Applied Microbiology** |
|  |  |
| **Category** | Elective -II | Year | I | **Credits** | 3 | **Course Code** | **EC-II** |
| **Semester** | II |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 4 | - | -- | 4 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Learn about the bio fertilizer and bio pesticides preparation.  |
| **LO2** | Describe the preparation and advantages of fermented foods. |
| **LO3** | Explain the methods of Single Cell Protein, alcoholic beverages and vitamin production. |
| **LO4** | Outline the biodegradation process, biogas production and waste water treatmen process. |
| **LO5** | Interpret the role of transgenic plants and animals. |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Fertilizer preparation and its applications – Rhizobium, Mycorrhizae and Vermicomposting. Bacterial pesticides - *Bacillus thuringiensis*. |  12 |
| **II** | Fermented food products – yoghurt, idly, bread and pickles – preparation and its advantages  |  12 |
| **III** | SCP (Spirulina) - Mushroom production (Oyster mushroom) - alcoholic beverages – Beer, wine productions - Vitamin B12 production. |  12 |
| **IV** | Biodegradation of pesticides (DDT), Biogas-Methane, Waste water treatment. |  12 |
| **V** | Transgenic animals (sheep) – transgenic plants (golden rice) and Definition and uses of synthetic seeds. |  12 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able; |
| **CO1** | Develop an understanding about the preparation and application of Rhizobium, Mycorrhizae, vermicompost.  |
| **CO2** | Acquire the knowledge of biotechnology in food production and processing of yoghurt, idly and pickles |
| **CO3** | Demonstrate the various technique to know about the production of mushroom, beer, wine and vitamine B 12. |
| **CO4** | Understand the important role of micro organisms in maintain healthy environment by using biodegradation of pesticide , biogas and waste water treatment |
| **CO5** | Summarize the methods used to produce transgenic plant and explain the selection process of synthetic seeds |

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| **Text Books**  |
| 1 | Casida J.F., Industrial Microbiology, Wiley Eastern Ltd., New Delhi, 1968. |
| 2 | Alexander N., Glazer and Hiroshi Nikaido, Microbial Biotechnology, Freeman W.H. and Co. New York, 1995 |
| **References Books** |
| 1 | Banwart J., Basic Food Microbiology, CBS Publishers and Distributors, New Delhi, 1987. |
| 2 | Campbell W., Robinson and John A., Howell, Comprehensive Biotechnology, Volume I, II, III and IV, Elsevier Publications, Oxford, England, 2004. |
| **Web Resources** |
| 1 | <https://www.slideshare.net/PavanKundur/rhizobium-biofertilizer-mass-production>, <https://byjus.com/biology/vermicomposting/> |
| 2 | <https://www.hengel.com/en/bread-fermentation-methods.html> |
| 3 |  <https://www.mushroomcouncil.com/growing-mushrooms/six-steps-to-mushroom-farming/> |
| 4 | <https://www.owlgen.com/question/write-a-short-note-on-biogas/>, <https://www.cliffsnotes.com/study-guides/biology/microbiology/aquatic-microbiology/sewage-and-wastewater-treatment> |
| 5 |  <http://biology-pages.info/T/TransgenicAnimals.html> |

 **Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- |
|  **POs COs** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** |
| **CO1** | 3 | 3 | 2 | 2 | 3 |
| **CO2** | 3 | 3 | 1 | 2 | 2 |
| **CO3** | 2 | 3 | 1 | 3 | 3 |
| **CO4** | 3 | 3 | 1 | 3 | 3 |
| **CO5** | 3 | 3 | 2 | 3 | 3 |

 S – STRONG M - MEDIUM L – LOW

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| Title of the Course | **Nutrition & Health Hygiene** |
|  |  |
| **Category** | **Skill Enhancement Course -SEC-2 (NME)** | Year | I | **Credits** | 2 | **Course Code** | **SEC - II** |
| **Semester** | II |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 2 | - | -- | 2 | 25 | 75 | 100 |
| **Learning Objectives** |
| **LO1** | Learn about nutrition and their importance  |
| **LO2** | Make student understand the nutritional facts for a better life. |
| **LO3** | Learn information to optimize our diet |
| **LO4** | Impart knowledge on different health care programs taken up by India |
| **LO5** | Learn knowledge on different health indicators and types of hygiene methods |
| **UNIT** | **Details** | **No. of Periods for the Unit** |
| **I** | Nutrition – definition, importance, Good nutrition, and mal nutrition; Balanced Diet: Basics of Meal Planning. Carbohydrates, Lipids, Proteins and Vitamins –functions, dietary sources, effects of deficiency. Macro and micro minerals –functions, effects of deficiency; food sources of Calcium, Potassium, and Sodium; food sources of Iron, Iodine, and Zinc. Importance of water– functions, sources, requirements and effects of deficiency | 6 |
| **II** | Nutrition for Life Cycle: Balanced diet - Normal, Pregnant, lactating women, Infancy, young children Adolescents, Adults, and the Elderly; Diet Chart; Nutritive value of Indian foods. | 6 |
| **III** | Improper diets: Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder - hypertension, diabetes, anemia, osteomalacia, cardiovascular disease.  | 6 |
| **IV** | Health - Determinants of health, Key Health Indicators, Environment health & Public health; Health-Education: Principles and Strategies. Health Policy & Health Organizations: Health Indicators and National Health Policy of Govt. of India; Functioning of various nutrition and health organizations in India. | 6 |
| **V** | Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation & Nutritional committee. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places. | 6 |

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| **Course Outcomes** |
| **Course Outcomes** | On completion of this course, students will be able to; |
| **CO1** | Learn the importance of nutrition for a healthy life |
| **CO2** | Study the nutrition for life cycle |
| **CO3** | Know the health care programmes of India |
| **CO4** | Learn the importance of community and personal health & hygiene measures |
| **CO5** | Create awareness on community health and hygiene |

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| **Text Books**  |
| 1. | Bamji, M.S., K. Krishnaswamy& G.N.V. Brahmam (2009) Textbook of HumanNutrition(3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi |
| 2. | Swaminathan (1995)Food &Nutrition(Vol I, Second Edition) The Bangalore Printing&Publishing Co Ltd., , Bangalore |
| 3 | SK. Haldar(2022). Occupational Health and Hygiene in Industry. CBS Publishers. |
| 4 | Acharya, Sankar Kr, Rama Das, Minati Sen (2021). Health Hygiene and Nutrition Perception and Practices.Satish Serial Publishing House |
| 5 | Dass (2021).Public Health and Hygiene, Notion Press |
| **References Books** |
| 1 | VijayaKhader (2000)Food, nutrition & health, Kalyan Publishers, New Delhi |
| 2 | Srilakshmi, B., (2010)Food Science, (5th Edition) New Age International Ltd., New Delhi |
| 3 | Arvind Kumar Goel (2005). A College Textbook of Health & Hygiene,ABD Publishers |
| 4 | Sharma D. (2015).Textbook on Food Science and Human Nutrition. Daya Publishing House. |
| 5 | Revilla M. K. F., Titchenal A. and Draper J. (2020). Human Nutrition. University of Hawaii, Mānoa. |
| **Web Resources** |
|  1  | National Rural Health Scheme:https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49 |
| 2 | National Urban Health Scheme:https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137 |
| 3 | Village health sanitation & Nutritional committeehttps://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225 |
| 4 | Health Impact Assessment - https://www.who.int/hia/about/faq/en/ |
| 5 | Healthy Living https://www.nhp.gov.in/healthylivingViewall |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO1 0** |
| **CO 1** |  |  |  |  | 3 | 2 | 2 | 2 |  | 3 |
| **CO 2** |  |  |  |  | 3 | 2 | 2 | 2 |  | 3 |
| **CO 3** |  |  |  |  | 3 | 2 | 2 | 2 |  | 3 |
| **CO 4** |  |  |  |  | 3 | 3 | 1 |  |  | 3 |
| **CO 5** |  |  |  |  | 3 | 3 | 2 |  |  | 3 |

3 – Strong, 2 – Medium , 1 - Low

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** | 3 | 2 | 2 | 2 | 3 |
| **CO2** | 3 | 2 | 2 | 2 | 2 |
| **CO3** | 3 | 3 | 2 | 2 | 2 |
| **CO4** | 2 | 2 | 2 | 1 | 2 |
| **CO5** | 2 | 3 | 1 | 1 | 1 |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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| --- | --- |
| Title of the Course | **SERICULTURE**  |
|  |  |
| **Category** | **Skill Enhancement Course -SEC-3 (NME)** | Year | I | **Credits** | 2 | **Course Code** | **SEC-III** |
| **Semester** | II |
| **Instructional Hours****per week** | **Lecture** | **Tutorial** | **Lab Practice** | **Total** | **CIA** | **External** | **Total** |
| 2 | - | -- | 2 | 25 | 75 | 100 |
| **Learning Objectives** |
| LO1 | Acquire knowledge on the concepts of origin, growth and study of Sericulture as science and scientific approach of mulberry plant. |
| LO2 | Describe the morphology and physiology of silkworm. |
| LO3 | Discuss effective management of silkworm diseases. |
| LO4 | Demonstrate field skills in mulberry cultivation and silkworm rearing with an emphasis on technological aspects. |
| LO5 | Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises. |

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| **Unit** | **Details** | **No. of Hours** |
| I | General introduction to Sericulture, its distribution in India. Botanical distribution and taxonomical characters of mulberry varieties and species.Biology of Mulberry plant and Mulberry crop cultivation and protection. | 6 |
| II | Silkworm- biology-morphology of silkworm. Life cycle of silkworm- egg, larva, pupa, and moth.  | 6 |
| III | Silkworm pathology: Introduction to Parasitism, Commensalism, Symbiosis and Parasite relationship - Mulberry Silkworm Diseases: Introduction, types, Pebrine, Grasserie, Muscardine, Flacherie, Symptoms and Pathogens, Mode of Infection, Prevention and Control -Non – mulberry silkworm diseases: Pebrine, Bacterial and viral diseases. Brief Account of Pests and Predators of Silkworms, Nature of damage and control measures. | 6 |
| IV | Rearing of silkworm. Cocoon assessment and processing technologies. Value added products of mulberry and silkworms. | 6 |
| V | Entrepreneurship and rural development in sericulture:Planning for EDP, Project formulation, Marketing, Insectary facilities and equipments: Location, building specification, air conditioning and environmental control, furnishings and equipment, sanitation and equipment, subsidiary facilities. | 6 |
| **Course Outcomes** | On completion of this course, students will be able to; |
| **CO1** | Discuss the overall aspects of Sericulture and the biology and varieties of mulberry plant.Creates awareness among students about the economic importance and suitability of Sericulture in Indian conditions. |
| **CO2** | Familiarize with the lifecycle of silk worm. |
| **CO3** | Explain common diseases of silkworm encountered during rearing, sources of infection, disease symptoms, pre-disposing factors and their management practices. |
| **CO4** | Attain thorough knowledge about the cultivation of mulberry, maintenance of the farm, seed technology, silkworm rearing, post cocoon techniques like stifling, reeling, and utilization of by-products. |
| **CO5** | Plan the facilities required for establishment of insectary.Competent to transfer the knowledge and technical skills to the Seri-farmers.Analyze the importance of sericulture in entrepreneurship development and emerge as potential entrepreneur. |

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| **Text Books**  |
| **1** | Ganga, G. and Sulochana Chetty (2010). Introduction to Sericulture,, J., Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi. |
| **2** | Dr. R. K. Rajan&Dr. M. T. Himantharaj(2005). Silkworm Rearing Technology, Central Silk Board, Bangalore. |
| **3** | Dandin S B, Jayant Jayaswal and Giridhar K (2010). Handbook of Sericulture technologies,Central Silk Board, Bangalore. |
| **4** | M. C. Devaiah, K. C. Narayanaswamy and V. G. Maribashetty(2010). Advances in Mulberry Sericulture,,CVG Publications, Bangalore |
| **5** | T.V.SatheandJadhav.A.D.(2021). Sericulture and Pest Management, Daya Publishing House. |
| **References Books** |
| **1** | S. Morohoshi (2001). Development Physiology of Silkworms 2nd Edition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi |
| **2** | Hamamura, Y (2001). Silkworm rearing on Artificial Diet. Oxford & IBH publishing Co., Pvt. Ltd. NewDelhi. |
| **3** | M.Johnson, M.Kesary (2019). Sericulture, 5th. Edition. Saras Publications. |
| **4** | [**Manisha Bhattacharyya**](https://www.abebooks.com/book-search/author/manisha-bhattacharyya?cm_sp=det-_-srp-_-author) **(2019).** [Economics of Sericulture](https://www.abebooks.com/servlet/BookDetailsPL?bi=30305682892&searchurl=fe%3Don%26pt%3Dbook%26sortby%3D17%26tn%3Dsericulture&cm_sp=snippet-_-srp1-_-title1), Rajesh Publications. |
| **5** | [**Muzafar Ahmad Bhat, Suraksha Chanotra, Zafar Iqbal Buhroo, Abdul Aziz and Mohd. Azam**](https://www.abebooks.com/book-search/author/muzafar-ahmad-bhat-suraksha-chanotra-zafar-iqbal-buhroo-abdul-aziz-and-mohd-azam?cm_sp=det-_-srp-_-author) **(2020).** [A Textbook on Entrepreneurship Development Programme in Sericulture](https://www.abebooks.com/servlet/BookDetailsPL?bi=30865738060&searchurl=sortby%3D17%26tn%3Dtextbook%2Bsericulture&cm_sp=snippet-_-srp1-_-title1), IP Innovative Publication. |
| **Web Resources** |
| **1** | https://egyankosh.ac.in › bitstream  |
| **2** | https://archive.org › details › SericultureHandbook |
| **3** | <https://www.academic.oup.com> |
| **4** | <https://www.sericulture.karnataka.gov.in> |
| **5** | <https://www.silks.csb.gov.in> |

**Mapping with Programme Outcomes:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CO/PO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** |
| **CO1** | 3 |  |  |  | 3 |  | 3 |  |  |  |  |
| **CO2** | 2 |  |  |  | 3 |  |  |  |  |  |  |
| **CO3** | 3 |  |  |  | 3 |  |  |  |  |  |  |
| **CO4** |  |  |  |  |  |  | 3 | 3 |  | 3 |  |
| **CO5** |  |  |  |  | 3 |  | 3 | 3 |  |  |  |

 3 – Strong, 2 – Medium, 1 - Low

**Mapping with Programme Specific Outcomes:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **CO /PO** | **PSO1** | **PSO2** | **PSO3** | **PSO4** | **PSO5** |
| **CO1** |  |  |  |  |  |
| **CO2** |  |  |  |  |  |
| **CO3** |  |  |  |  |  |
| **CO4** |  |  |  |  |  |
| **CO5** |  |  |  |  |  |
| **Weightage** |  |  |  |  |  |
| **Weighted percentage of Course Contribution to Pos** |  |  |  |  |  |

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