# B.Sc., Microbiology

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **23BMIA1** | **BASIC AND CLINICAL BIOCHEMISTRY** | Elective Generic / Discipline Specific Elective-I | **Y** | **-** | **-** | **-** | **3** | **3** | **25** | **75** | **100** |

| **Course Objectives** | |
|---|---|
| CO1 | Attain thorough knowledge on carbohydrates and lipids, their characteristic properties and organization in carrying out all the living functions which constitute the life. |
| CO2 | Explain the biological activity of amino acids and proteins. |
| CO3 | Identify the metabolic errors in enzymes of carbohydrates and lipids. |
| CO4 | Describe the disorders in amino acid metabolism. |
| CO5 | Interpret the consequences, biochemical, clinical features, diagnosis and treatment of metabolic diseases of day today life. |

| | **Details** | **No.of Hours** | **Course Objectives** |
|---|---|---|---|
| **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 | CO1 |
| **UNIT II** | Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance. | 12 | CO2 |
| **UNIT 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 | CO3 |
| **UNIT IV** | Disorders of Metabolism: Disorders of amino acid metabolism:alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias. | 12 | CO4 |
| **UNIT V** | Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions.<br>Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase. | 12 | CO5 |
| | Total | 60 | |

| **Course Outcomes** | | |
|---|---|---|
| **Course Outcomes** | On completion of this course, students will; | |
| CO1 | Explain the structure, classification , biochemical functions and significance of carbohydrates and lipids | PO1 |

| | | |
|---|---|---|
| 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. | PO1 |
| CO3 | Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism. | PO4, PO5, PO6 |
| CO4 | Discuss and evaluate the pathology of aminoacid metabolic disorders. | PO4, PO5, PO6 |
| CO5 | Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis. | PO5, PO6, PO9 |

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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. 2ndEdition, Chapman and Hall. |
| 2 | David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry, 7thEdition W.H. Freeman and Co., NY. |
| 3 | LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9thEdition ,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:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | | | | | | | | | |
| CO2 | M | | | | | | | | | | |
| CO3 | | | | S | S | S | | | | | |
| CO4 | | | | S | S | S | | | | | |
| CO5 | | | | | S | S | | | S | | |

| Semester –I | | | | | |
|---|---|---|---|---|---|
| **Course Code 23BMIAP1** | **Title of the Course** | **Lab-I: Lab in General Microbiology** | **P** | **Credits 2** | **Hours2** |
| **Objective1** | ➢ Gain knowledge on Media preparation<br>➢ Prepare media for bacterial growth. Discuss about plating and growth measurement techniques<br>➢ Identify the microbes by different staining methods<br>➢ Discuss the plate count and heamocytometric count method<br>➢ To Identify the organism based on biochemical test,Acquire knowledge on assessment of milk quality and water quality by various methods | | | | |

1. **Preparation of media**: nutrient broth, nutrient agar plate, soft agar.
2. **Pure culture techniques**: streak plate, spread plate and pour plate.
3. **Motility determination** – Hanging drop method and soft agar method
4. **Isolation of bacteria**- From different environmental samples (Soil, water, food).
5. **Enumeration of bacteria** - viable count (plate count) and total count (Haemocytometer count). **Direct microscopic observation**: fungal spores and mycelium (KOH Mount)
6. **Staining method**: simple, negative, Gram's staining and spore staining.
7. **Biochemical methods** - IMViC test, $H_2S$, TSI, Oxidase, catalase, urease test
8. **Water quality Assessment:**Analysis of drinking water(MPN).

| | |
|---|---|
| **Outcome1** | • Demonstrate the various types of media preparation.<br>• Isolate and Identifying the pure colonies by applying different plating methods<br>• Determine the motility of bacteria, Apply the differential staining procedure to differentiate bacteria based on gram staining.<br>• Distinguish the viable and total count of cells by plate count and heamocytometric count method<br>• Elaborate on the bacterial identification - physiological, and biochemical methods.Analysis the portability of water |

**Reference and Textbooks:-**


Aneja, K.R. (2003). Experiments in Microbiology: Plant Pathology and Tissue Culture, New Delhi: WishwaPrakashan.

Aneja, K.N. (2018). Lab Manual of Microbiology and Biotechnology, Medtec Publisher

Cappuccino, J.H. and Sherman, N. (2014). Microbiology – A Lab Manual (10th ed). Singapore: The Benjamin Publishing Company.

David, T. Plummer, (1992). An introduction to practical Biochemistry (3rd ed). New Delhi: Tata McGraw Hill publishing Com. Ltd.

Gunasekaran, P. (1995). Laboratory Manual in Microbiology. New Delhi: New Age International (P) Ltd. Publishers.

Gold man, E and Green, H.(2008) . Practical handbook of microbiology. CRC press Jayaraman, J. (1981). Laboratory Manual in Biochemistry. New Delhi: New Age International (Pvt.) Ltd. Publishers.

Palanivel, P. (2009). Laboratory Manual for Analytical Biochemistry & Separation Techniques. (4th ed). School of Biotechnology, Madurai Kamaraj University, Madurai.

Reddy, C. A., Beveridge, T. J., Breznak, J. A., Marzluf, G. A., Schmidt, T. M., & Snyder L. R. (2007). Methods for General and Molecular Microbiology (3rd ed). Washington: American Society for Microbiology.

Trivedi, R. (2016). Practical Mannual in Microbial Physiology and Industrial Microbiology. New Delhi: SSDN Publishers

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst.Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **23BMIA2** | **BIO INSTRUMENTATION** | Elective Generic/ Discipline Specific Elective II | **Y** | **-** | **-** | **-** | **3** | **3** | **25** | **75** | **100** |

| **Course Objectives** | |
|---|---|
| CO1 | Understand the analytical instruments and study the basic principles in the field of sciences. |
| CO2 | To gain knowledge about principles of spectroscopy |
| CO3 | Understand the analytical techniques of Chromatography and electrophoresis |
| CO4 | To understand the principle of different types of scans used in medical diagnosis |
| CO5 | To gain information about the principles of radioactivity and its measurements |

| Unit | Details | No.of Hours | Course Objectives |
|---|---|---|---|
| **Unit I** | Basic instruments: pH meter, Buffer of biological importance, Centrifuge- Preparative, Analytical and Ultra, Laminar Air Flow, Autoclave**,** Hot Air Oven and Incubator. Biochemical calculations- preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation. | 12 | CO1 |
| **Unit II** | Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infra red and Mass Spectroscopy. | 12 | CO2 |
| **Unit III** | Chromatographic and Electrophoresis Techniques:Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Starch Gel, AGE, PAGE. | 12 | CO3 |
| **Unit IV** | Imaging techniques:Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radioisotopes. | 12 | CO4 |
| **Unit V** | Fluorescence and radiation based techniques:Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography. | 12 | CO5 |
| | Total | 60 | |

| **Course Outcomes** | | |
|---|---|---|
| **Course Outcomes** | On completion of this course, students will; | |
| CO1 | Gain knowledge about the basics of instrumentation. | PO1,PO4,PO11 |
| CO2 | Exemplify the structure of atoms and molecules by using the principles of spectroscopy. | PO4,PO10,PO11 |
| CO3 | Evaluate by separating and purifying the components. | PO4,PO7,PO11 |
| CO4 | Understand the need and applications of imaging techniques. | PO7,PO8,PO11 |
| CO5 | Categorize the working principle and applications of fluorescence and radiation. | PO10,PO11 |

| **Text Books** | |
|---|---|
| 1. | Jayaraman J (2011). Laboratory Manual in Biochemistry, 2nd Edition. Wiley Eastern Ltd., New Delhi . |
| 2. | Ponmurugan. P and Gangathara PB (2012). Biotechniques.1stEdition. MJP publishers. |

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|---|---|
| 3 | Veerakumari, L (2009).Bioinstrumentation- 5 thEdition -.MJP publishers. |
| 4 | Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3rd Edition. Himalaya publishing home. |
| 5 | Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya Publishing House, Mumbai. |
| **References Books** | |
| 1 | Rodney.F.Boyer (2000). Modern Experimental Biochemistry, 3rd Edition. Pearson Publication. |
| 2 | SkoogA.,WestM (2014). Principles of Instrumental Analysis – 14th Edition W.B.SaundersCo.,Philadephia. |
| 3 | N.Gurumani. (2006). Research Methodology for biological sciences- 1st Edition – MJP Publishers . |
| 4 | Wilson K, and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology.7thEdition. Cambridge University Press . |
| 5 | Webster, J.G. (2004). Bioinstrumentation- 4th Edition - John Wiley & Sons (Asia) Pvt.Ltd,Singapore. |
| **Web Resources** | |
| 1 | http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction-types- uses-and-other-details-with-diagram/12489 |
| 2 | https://www.watelectrical.com/biosensors-types-its-working-andapplications/ |
| 3 | http://www.wikiscales.com/articles/electronic-analytical-balance/ Page 24 of 75 |
| 4 | https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html |
| 5 | http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction |

**Mapping with Programme Outcomes**:

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | L | | | M | | | | | | | S |
| CO2 | | | | L | | | | | | M | S |
| CO3 | | | | L | | | M | | | | S |
| CO4 | | | | | | | S | S | | | S |
| CO5 | | | | | | | | | | M | S |

| Course Code 23BMIAP2 | Title of the Course | Lab-I: BIOINSTRUMENTATION PRACTICAL | P | Credits 2 | Hours 2 |
|---|---|---|---|---|---|

1) Principlesandmethodsofsterilization.
2) Principlesandmethodsof using pH meter.
3) Principlesandmethodsof using Colorimeter.
4) Principlesandmethodsof using UV-Vis Spectrophotometer.
5) Principlesandmethodsof using Microscopes.
6) Principlesandmethodsof using Centrifuge in separating Microbial cultures.
7) Principlesandmethodsof using Centrifuge in separating Microbial based proteins/enzymes.
8) Principlesandmethodsof using Laminar air flow.
9) Principlesandmethodsof using Hot air oven.

**References**


1. Microbiology: A Laboratory Manual (2002) by J.G. Cappuccino and N. Sherman, Addison-Wesley.
2. Laboratory Manual of Experimental Microbiology (1995) by R.M. Atlas, A.E.Brown and L.C.Parks, Mosby, St. Louis.
3. Microbiology Laboratory Manual (2003) by T. Sundararaj, No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096 2nd Edition.
4. Casida L.E. Industrial Microbiology, Wiley Eastern Limited, New Delhi.
5. PrescottS.C. and Dunn C.C. Industrial Microbiology, Tata McGraw-Hill PublishingCompany limited, New Delhi.

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst. Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **23BMIA3** | **CLINICAL LABORATORY TECHNOLOGY** | **ELECTIVE GENERIC/DISCIPLINE SPECIFIC ELECTIVE -III** | **Y** | **-** | **-** | **-** | **3** | **3** | **25** | **75** | **100** |

| **Learning Objectives** | |
|---|---|
| CO1 | Demonstrate ethical and professional conduct with patients, laboratory personnel, health- care professionals, and the public. |
| CO2 | Explain how accurate and reliable information might be obtained about proper procurement, storage, and *handling* of laboratory *specimens*. |
| CO3 | Develop a sound scientific knowledge foundation that prepares them to interpret, analyze and evaluate scientific knowledge in clinical practice. |
| CO4 | Perform a full range of laboratory tests with accuracy and precision. |
| CO5 | Establish quality assurance principles and practices to ensure the accuracy and reliability of laboratory information. |

| Unit | Details | No.of Hours | Course Objectives |
|---|---|---|---|
| **Unit I** | **Introduction to Clinical Laboratory Science**: Basic laboratory principles - Code of conduct for medical laboratory personnel - Organization of clinical laboratory and role of medical laboratory technician - Safety measures. Assessment of a patient and brief history of collection. Maintenance of Hygiene & Infection Control Practices. | 12 | CO1 |
| **Unit II** | **Specimen collection and processing** - Blood, urine, stool, sputum CSF, amniotic fluid and bile. Separation of serum and plasma, Handling of specimens for testing, preservation of specimens, transport of specimens and factors affecting the clinical results. | 12 | CO2 |
| **Unit III** | **Introduction to histopathology**-Methods of examination of tissues and cells, Fixation of tissues: Classification and properties of fixatives. Tissue processing - Collection of specimens, Labeling and fixation, Dehydration, Clearing, Impregnation, Embedding - Paraffin block making, Section Cutting, Microtomes – types and mounting of sections. | 12 | CO3 |
| **Unit IV** | **Introduction to Haematology**- Laboratory methods used in the investigation of coagulation disorders - coagulation tests , Routine coagulation tests, (prothrombin time , plasma recalcification time,partial thromboplastin time , activated partial thromboplastin time, thrombin time), Laboratory diagnosis of bleeding disorders. Estimation of fibrinogen, Assay of coagulation factors. | 12 | CO4 |
| **Unit V** | **Quality Standards in Health Laboratories** – Development and implementation of standards, Accreditation Boards –NABL, ISO, CAP, COLA, Performing quality assessment - pre-analytical, analytical, and post-analytical phases of testing. | 12 | CO5 |
| | Total | 60 | |
| | | | |

| Course Outcomes | | |
|---|---|---|
| **Course Outcomes** | On completion of this course, students will; | |
| CO1 | Describe characteristics of laboratory organizations and demonstrate professionalism by displaying professional conduct, model ethical behavior and operate as a vital member of the medical lab team.<br>Practice safety or infection control procedures in the clinical laboratory, properly use safety equipment and maintain a clean, safe work environment. | PO3, PO11 |
| CO2 | Accurately collect specimens for various purposes. Determine appropriate tests based on test request, Maintain standard and transmission-based precautions, Engage in the scientific process by understanding the principles and practices of clinical study design, implementation, and dissemination of results. | PO5, PO6, PO11 |
| CO3 | Identify the basic structure of cells, tissues and organs and describe their contribution to normal function. Interpret light and electron microscopic histological images and identify the tissue source and structures. Relate and recognize the histological appearance of affected tissues to the underlying pathology. | PO6, PO8, PO9, PO11 |
| CO4 | Recognize the pathologies behind benign and malignant disorders of erythrocytes, leucocytes, thrombocytes and familiar with the diagnosis, evaluation, and management of hematologic malignancies. | PO5, PO6, PO9, PO11 |
| CO5 | Interpret, implement, and complying with laws, regulations and accrediting standards and guidelines of relevant governmental and non-governmental agencies. | PO1,PO10 |

| **Text Books** | |
|---|---|
| 1. | Mukharji,K.L. (2000).Medical Laboratory Techniques, Vol - I, II & III, 5th Edition. Tata McGrawHill, Delhi. |
| 2. | Ochei,A., Kolhatkar.A. (2000).Medical Laboratory Science: Theory and Practice, McGraw Hill Education. |
| 3 | RamnikSood (2015).Concise Book of Medical Laboratory Technology:Methods and Interpretation, 2nd Edition, Jaypee Brothers Medical Publishers, NewDelhi. |
| 4. | S. Ramakrishnan, KN Sulochana(2012). Manual of Medical Laboratory Techniques,Jaypee Brothers Medical Publishers Pvt. Ltd |
| 5. | Talib V.H. (2019).Handbook Medical Laboratory Technology, 2nd Edition, Directorate of health services, Government of India. |
| **References Books** | |
| 1 | Rutherford, B.H. Gradwohl , A.C. Sonnenwirth L. Jarett. Gradwohls. (2000). Clinical Laboratory Methods and Diagnosis, Vol-I, 8th edition, Mosby. |
| 2 | Baker, F.J., Silverton, R.E., and Pallister,.J. (1998). An Introduction to Medical Laboratory Technology, 7th Edition, CBS Publishers and Distributors Pvt. Ltd. |
| 3 | Godkar (2021).Textbook of Medical Laboratory Technology, 3rd Edition,Bhalani Publishing House. |
| 4 | M.N.Chatterjee and RanaShinde.(2008). Textbook of Medical Biochemistry, 7th Edition, Jaypee Brothers Medical Publishers Pvt. Limited. |
| 5 | James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual.(5th Edition).The Benjamin publishing company. New York. |
| | |

| Web Resources | |
|---|---|
| 1 | https://www.jaypeedigital.com › book |
| 2 | https://www.pdfdrive.com › wintrobes-clinical-hematology |
| 3 | https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5 |
| 4 | https://vlab.amrita.edu/index.php?sub=3&brch=272 |
| 5 | https://nptel.ac.in/courses/102105087 |

**Mapping with Programme Outcomes:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | M | | | | | | | | S |
| CO2 | | | | | M | S | | | | | S |
| CO3 | | | | | | S | | S | | S | S |
| CO4 | | | | | M | S | | | S | | S |
| CO5 | M | | | | | | | | | M | |

| Course Code 23BMIAP3 | Title of the Course | Lab-I: CLINICAL LABORATORY TECHNOLOGY PRACTICAL | P | Credits 2 | Hours 2 |
|---|---|---|---|---|---|

1. Blood grouping and Rh typing.
2. Test for urine sugar (Benedict's method)
3. Estimation of blood glucose
4. Estimation of serum protein
5. Preparation of blood agar and demonstration of hemolysis.
6. Antibiotic sensitivity tests.
7. Assessment of minimum inhibitory concentration.

**References**


1. Dr. S. Rajan, Manual for Medical Laboratory Technology (2012), Anjanaa Book House, Chennai.
2. Gradwohls, (2000). Clinical Laboratory Methods and Diagnosis, M.D.B.I. Publications, New Delhi.
3. Richard R, (1989). Clinical Laboratory Medicine, Medical Publi, Chicago.

Williams and J. William, (1990). Haematology. Mc Graw Hill, New York.

4. Kanai L. Mukherjee, (1996). Medical Laboratory Technology, Volume-I. Tata Mc Graw Hill, New Delhi.

| Subject Code | Subject Name | Category | L | T | P | S | Credits | Inst.Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | CIA | External | Total |
| **23BMIA4** | **FOOD PROCESSING TECHNOLOGY** | **ELECTIVE GENERIC/ DISCIPLINE SPECIFIC ELECTIVE -IV** | **Y** | **-** | **-** | **-** | **3** | **3** | **25** | **75** | **100** |

| **Learning Objectives** | |
|---|---|
| CO1 | To provide knowledge on objectives of food preservation. |
| CO2 | To explain the freshness criteria and quality assessment of meat and fish. |
| CO3 | To outline the methods of milk processing and fermented milk products. |
| CO4 | To explain the importance of fat and oil processing. |
| CO5 | To discuss the methods of microbiological examination of foods. |

| **Unit** | **Details** | **No.of Hours** | **Course Objectives** |
|---|---|---|---|
| **Unit I** | Introduction to food preservation –objectives and techniques of food preservation. Preservation: principles of high temperature, low temperature, radiation, chemical preservatives and bio preservatives. | 12 | CO1 |
| **Unit II** | Freshness criteria and quality assessment of meat and fish –spoilage and methods of preservation. Production of byproducts after processing waste and their utilization. Role of packaging material, types of packaging material. | 12 | CO2 |
| **Unit III** | Composition of milk; assessment of milk, thermal processing of fluid milk-pasteurization (LTH, HTST&UHT techniques). Fermented milk products-cheese, Butter milk, Yogurt, Kumis, Kefir and Acidophilus milk. Hygiene and sanitation requirement in food processing and fermentation industries. | 12 | CO3 |
| **Unit IV** | Importance of fats and oils in Food-Extraction of fats and Oils-Rendering, pressing, solvent extraction, pressing of oil- degumming, refining, bleaching, deodorization, fractionation, pyrolysis of fats, toxicity of frying oil. | 12 | CO4 |
| **Unit V** | Methods for the microbiological examination of foods. Food borne illness and diseases. Microbial cultures for food fermentation. Indian Factories Act on safety, HACCP, Safety from adulteration of food. | 12 | CO5 |
| | Total | 60 | |

**Course Outcomes**

| **Course Outcomes** | On completion of this course, students will; | |
|---|---|---|
| CO1 | Assess the fundamental concepts of food preservation. | PO1, PO3, PO5,PO6, PO8 |
| CO2 | Investigate the quality assessment of meat and fish. | PO1, PO5, PO6, PO7, PO8 |
| CO3 | Design the processing of milk and milk quality assessment. | PO1, PO5, PO6, PO7, PO8 |
| CO4 | Explain about the importance of fats and oils. | PO1, PO4, PO6, PO7, PO8 |

| | | |
|---|---|---|
| CO5 | Plan the food safety and adulteration detection. | PO3, PO4, PO6, PO7, PO8 |
| **Text Books** | | |
| 1. | Avantina Sharma. (2006). Text Book of Food Science and Technology, International Book Distributing Co, Lucknow, UP. | |
| 2. | Sivasankar. (2005). Food Processing and Preservation, 3rd Edition.,Prentice hall of India Pvt Ltd,NewDelhi. | |
| 3 | Ramaswamy H & Marcotte M. (2006). Food Processing: Principles & Applications. Taylor & Francis. | |
| 4 | NIIR Board of Food and Technologist. (2005). Modern Technology of Food Processing and Agrobased industries, National Institute of Industrial Research, Delhi. | |
| 5 | Adams M.R. and Moss M. O (2007).Food Microbiology.New Age International. | |
| **Reference Books** | | |
| 1 | Fellos PJ. (2005). Food Processing Technology: Principle &Practice 2nd Edition. CRC. | |
| 2 | Peter Zeuthen and Leif Bogh-Sorenson. (2005). Food Preservation Techniques, WoodlandPublishing Ltd, Cambridge, England. | |
| 3 | Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. (2004). Novel Food Processing Technologies, CRC. | |
| 4 | Suman Bhatti, Uma Varma. (1995). Fruit and vegetable processing organizations and institutions, 1st Edition., CBS Publishing, New Delhi. | |
| 5 | MirdulaMirajkar, Sreelatha Menon. (2002). Food Science and Processing Technology Vol-2,Commercial processing and packaging, Kanishka publishers, New Delhi. | |
| **Web Resources** | | |
| 1 | https://sites.google.com/a/uasd.in/ecourse/food-processing-technology | |
| 2 | https://nptel.ac.in/courses/126105015 | |
| 3 | https://engineeringinterviewquestions.com/biology-notes-on-food-adulteration/ | |
| 4 | food processing \| Definition, Purpose, Examples, & Facts \| Britannica | |
| 5 | Food Processing Technology \| Food News & Views Updated Daily (foodprocessing-technology.com) | |

**Mapping with Programme Outcomes:**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|---|---|---|---|---|---|---|---|---|---|
| CO1 | M | | M | | S | M | | S | |
| CO2 | M | | | | S | M | S | S | |
| CO3 | M | | | | S | M | S | S | |
| CO4 | M | | | S | | S | S | S | |
| CO5 | | | M | M | | M | S | S | |

| Course Code 23BMIAP4 | Title of the Course | Lab-I: FOOD PROCESSING TECHNOLOGY PRACTICAL | P | Credits 2 | Hours 2 |
|---|---|---|---|---|---|

1. Viablecountofbacteriainmilk.
2. MethyleneBlueDyereductiontest.
3. Resazurindyereductiontest.
4. Phosphatasetest.
5. Litmusmilkreaction

**References**


1. Palanivel,P.(2000).LaboratoryManualforAnalyticalBiochemistry&SeparationTechniques. SchoolofBiotechnology,MaduraiKamarajUniversity,Madurai.
2. Aneja, K.R. (2003). Experiments in Microbiology: Plant Pathology and Tissue Culture. New Delhi: WishwaPrakashan.
3. Dr. S. Rajan, Manual for Medical Laboratory Technology (2012), Anjanaa Book House, Chennai.
4. Gradwohls, (2000). Clinical Laboratory Methods and Diagnosis, M.D.B.I. Publications, New Delhi.
5. Richard R, (1989). Clinical Laboratory Medicine, Medical Publi, Chicago. Williams and J. William, (1990). Haematology. Mc Graw Hill, New York.