SCHOOL OF BIOTECHNOLOGY & GENETIC ENGINEERING
DEPARTMENT OF MICROBIAL BIOTECHNOLOGY

Syllabus

M.Sc., Industrial Biotechnology (CBCS –UD)

2018-2020 BATCH & ONWARDS

Bharathiar University
Coimbatore-46

BHARATHIAR UNIVERSITY: COIMBATORE – 641 046
M.SC., INDUSTRIAL BIOTECHNOLOGY (UNIVERSITY)
FOR THE STUDENTS ADMITTED DURING THE ACADEMIC YEAR
2018 – 2020 BATCH & ONWARDS
SCHEME OF EXAMINATION

Semester/ Code No.	Paper	Subject	University examination			Credit
			Internal Mark	External Mark	Total Mark	
SEMESTER I						
18MBTAC01	Paper-I	Molecular cell biology	25	75	100	4
18MBTAC02	Paper - II	Basics of Microbiology	25	75	100	4
18MBTAC03	Paper - III	Microbial physiology and Biochemistry	25	75	100	4
18MBTAC04	Paper - IV	Microbial Genetics and Recombinant DNA Technology	25	75	100	4
18MBTGE12A	Elective 1 A	**List Enclosed**	25	75	100	4
18MBTGE12B	Elective 1 B	**List Enclosed**				
	Supportive 1	**List Enclosed**	12	38	50	2
18MBTACP1	Practical - I	Basic Microbiological Techniques	40	60	100	4
SEMESTER II						
18MBTAC05	Paper-V	Immunology and Immunotechniques	25	75	100	4
18MBTAC06	Paper - VI	Molecular pathogenesis and clinical diagnosis	25	75	100	4
18MBTAC07	Paper - VII	Food Biotechnology	25	75	100	4
18MBTAC08	Paper - VIII	Environmental Biotechnology	25	75	100	4
18MBTGE13A	Elective 2 A	**List Enclosed**	25	75	100	4
18MBTGE13B	Elective 2 B	**List Enclosed**				
	Supportive 1	**List Enclosed**	12	38	50	2
18MBTACP2	Practical - II	Advanced Microbiological Techniques	40	60	100	4
SEMESTER III						
18MBTAC09	Paper-IX	Bioinformatics and Nanobiotechnology	25	75	100	4
18MBTAC10	Paper – X	Biosafety, Bioethics , IPR and Biostatistics	25	75	100	4
18MBTAC11	Paper – XI	Research Techniques	25	75	100	4
18MBTAC12	Paper – XII	Bioprocess Technology	25	75	100	4
18MBTGE14A	Elective 3 A	**List Enclosed**				
18MBTGE14B	Elective 3 B	**List Enclosed**	25	75	100	4
	Supportive 1	**List Enclosed**	12	38	50	2

18MBTACP3	Practical - III	Applied Microbiological Techniques	40	60	100	4
SEMESTER IV						
18MBTGE15A	Elective 4 A	**List Enclosed**				
18MBTGE15B	Elective 4 B	**List Enclosed**	25	75	100	4
		Project viva voce*	60	90	150	6
		Industrial / Institute visit and Summer Training (Viva voce)**	50		50	2
		Grand total			2250	90

* The report should be a Bonafide work carried out by the candidate in the department or any other recognized institute or laboratory under the guidance of a faculty/external guide and should be authenticated and countersigned by the HOD. This project work must be presented and defended by the candidate in the department attended by all faculties and reviewed by external examiner. Candidate who has presented the work as 'Not qualified as per CBCS' must resubmit the project again in the ensuing academic year.

** The Industrial training report should be submitted by the candidate. This report must be presented and defended by the candidate in the department attended by all faculties.

ELECTIVE COURSES OFFERED

Semester/ Code No.	**Paper**	**Subject**	**University examination**			**Credit**
			Internal Mark	**External Mark**	**Total Mark**	
18MBTGE12 A	Elective 1A	Animal Biotechnology	25	75	100	4
18MBTGE12B	Elective 1B	Biomolecular Metabolism	25	75	100	4
18MBTGE13A	Elective 2A	Plant Biotechnology	25	75	100	4
18MBTGE13B	Elective 2B	Bioremediation & Waste Management	25	75	100	4
18MBTGE14 A	Elective 3A	Pharmaceutical Chemistry	25	75	100	4
18MBTGE14B	Elective 3B	Good Manufacturing Practices and Quality Assurance	25	75	100	4
FINISHING SCHOOL PAPER						
18MBTGE15A	Elective 4A	Hospital Management and Entrepreneurship development	25	75	100	4
18MBTGE15B	Elective 4B	Teaching Techniques in Sciences	25	75	100	4

SUPPORTIVE COURSES OFFERED

Semester	Paper	Subject	Hrs Per week	University examination		Credits
				Duration in Hrs.	Max. Marks	
SEMESTER I	18MBTGS24	Microbial Biotechnology	2	3	50	2
SEMESTER II	18MBTGS60	Food Biotechnology	2	3	50	2
SEMESTER III	18MBTGS25	Clinical Microbiology	2	3	50	2

SEMESTER I
PAPER I: 18MBTAC01 MOLECULAR CELL BIOLOGY

COURSE OBJECTIVES:

- Recalling the structural organization of organelles in both prokaryotic and eukaryotic cells
- Providing information on the functional aspects of the cellular organelles
- Understanding the molecular interaction of cells with regard to metabolism and cell cycle
- Perceiving the molecular interactions in terms of regulation of cell cycle

UNIT I

Cell architecture: Structure of cells – structure of prokaryotic and eukaryotic cells; Surface appendages – Cilia and Flagella, Capsules, Pili, Fimbriae and slime layers; Cell walls – Algae, fungi, bacteria ; Membranes of Gram positive, Gram negative bacteria and acid fast bacteria; protoplast, spheroplast and endospores; Transport across membrane – active and passive transport, transport channels and pumps, transport across nuclear membrane; Neurotransmission, neuromuscular junction.

UNIT II

Cellular constituents: Cytoskeleton and structural components – Microfilaments, Intermediate filaments, Microtubules; Mitochondria – structure, biogenesis; Chloroplast – structure, biogenesis; Endoplasmic reticulum and Golgi complex – structure, function, vesicular transport and import into cell organelles; Structure and function of ribosomes, mesosomes, lysosomes, peroxysomes.

UNIT III

Nucleus: Nucleus structure – structural organization, nucleosome, supranucleosomal structures, specialized chromosomes, polytene and lamp brush chromosomes and chromosome banding; Nucleic acid structure: DNA and RNA.

UNIT IV

Cell cycle: Mechanism of cell division – Mitosis, meiosis and genetic recombination; regulation of cell cycle – factors and genes regulating cell cycle (Cyclins, CDK and CDKI). Biochemistry and molecular biology of Cancer – malignant growth, tumour suppressor genes (p53, RB) and oncogenes (Ras), chemical carcinogenesis, hormonal imbalances.

UNIT V

Cellular development: Extracellular matrix – cell to cell and cell-matrix adhesion, cell junctions; Cellular systematic – components of systematic, receptors (cell surface – GPCR, RTK, TGF-β, Hedgehog, Wnt, Notch-Delta, NF-Kb, ion channels; intracellular – NO, Nuclear receptor), secondary messengers, effectors ; cell differentiation; gametogenesis and

fertilization; development of Drosophila and Arabidopsis – spatial and temporal regulation of gene expression.

TEXT BOOKS

1. Molecular Biology of Cell, Alberts, B et al.
2. Molecular cell Biology, Darnell, Lodish, Baltimore, Scientific American Books, Inc., 1994.

REFERENCES

1. Introduction to genetics: A molecular approach, T.A. Brown, Garland Science, 2011.
2. Molecular Biology of the Gene (7^{th} Edition, J.D.Watson, Tania A. Baker, Stephen P. Bell , Michael Levine, Richard Losick) Benjamin/Cummings Publ. Co., Inc., California, 2013.
3. Genes XI (9^{th} Edition) Benjamin Lewin, Jones & Bartlett Learning, 2008
4. Molecular biology and Biotechnology. A comprehensive desk reference, R.A. Meyers (Ed) Wiley-Blackwell Publishers, 1995

COURSE OUTCOMES:

CO 1 - Able to coordinate structural organization with functions
CO 2 - Abe to differentiate the prokaryotic and eukaryotic cells
CO 3 - Capable of understanding the molecular mechanism of several diseases
CO 4 - Capacity to determine the causes of cancer and drug resistance
CO 5 - Able to understand the molecular mechanisms of body movement
CO 6 - Abe to explain the process of development of organisms to adult

PAPER II: 18MBTAC02 BASICS OF MICROBIOLOGY

Course objectives:

- Recalling the history and theories in microbiological research.
- Gaining information on staining and sterilization techniques.
- Understanding the ultrastructure and function of prokaryotic and eukaryotic organisms.
- Learning various aspects of microbial nutrition and reproduction.

Unit- I

Early history & scope of Microbiology: Spontaneous generation conflict- Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Winogradsky, Paul Ehrlich, Lederberg and Zinder, Lwoff, Arber and Smith, Temin and Baltimore.

Microscopic techniques: Principles, working mechanism and application-simple, compound, dark field and phase contrast microscope, fluorescence, SEM & TEM.

Unit II

Methods of sterilization: physical methods-Dry heat, moist heat, radiation methods, filtration methods, chemical methods & their application. Preservation and maintenance of Microbial cultures- Lyophilizers, Deep freezer.

Microbial cultures: Methods of pure culture technique- Serial Dilution, Pour Plate, Spread Plate and Streaking methods. Microbiological Media- Types and composition of media.

Staining Techniques: Simple, Differential (Gram's AFB), special- capsular staining (negative), spore, Acid Fast Staning, Fungal Staning - LPCB.

Unit- III

Microbial Taxonomy: Domains and Kingdoms of Life- Bacterial Nomenclature- Classification of Bacteria by Physiological, Metabolic, Serological and Molecular methods- Bergey's Manual of Systematic Bacteriology with general characteristics of each division- Numerical Taxonomy- 16S rRNA based classification. Archeabacterium, Actinomycetes- Structure and Classification.

Unit – IV

General Characteristics and Classification of Algae (Fritsch Method). General Characteristics and Classification of Fungi (Alexopolus). General Characteristics and Classification of Protozoa. Structure and Reproduction of *Paramecium* sp.

Unit – V

General Properties and Classification of Viruses. Cultivation of Plant and Animal Viruses- Characterization and Enumeration of Viruses- Quantitative assay. Genome

replication, Protein synthesis and assembly of DNA containing Plant Viruses- CaMV and Gemini Virus- RNA containing Plant Viruses- TMV, Cowpea Mosaic Viruses.

Reference Books

- Prescott L M, J P Harley and D A Klein (2005). Microbiology.Sixth edition, International edition, McGraw Hill.
- PelczarTR M J Chan ECS and Kreig N R (2006). Microbiology.Fifth edition, Tata McGraw-Hill INC. New York.
- Hans G. Schlegel. General microbiology. 7th edition. Cambridge university press (1993).
- Dubey RC and Maheswari DK (2012). A text of Microbiology (Revised edition). S. Chand and Company Ltd., New Delhi.
- GeetaSumbali and Mehrotra RS (2009). Principles of Microbiology.First edition, Tata McGraw Hill P. Ltd., New Delhi.

Course Outcomes:

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

CO 1 - Gain a strong foundation on basic microbiological practices

CO 2 - Understand nature of microbial cell structure, function and nutrition

PAPER III: 18MBTAC 03 MICROBIAL PHYSIOLOGY AND BIOCHEMISTRY

Course objectives:

- To recall the bioenergetics' process of the microbe.
- To describe the mechanism of microbial fermentation process.
- To provide the information about the nutritional uptake of microbial cells.
- To familiarize the energy driven process of the microbes from inorganic substances.
- To know the regulatory responses of the environmental stress and changes in microbes.

UNIT I

Modes of nutritional uptake - Entry of nutrition in the cell, passive diffusion, facilitated diffusion and different mechanisms of active diffusion (Proton Motive Force, PTS, role of permeases in transport, different permeases in E. coli. Transport of aminoacids and inorganic ions in microorganisms and their mechanisms. Utilization of nutrients that cannot enter the cell

UNIT II

Principles of microbial metabolism: Methods used to study, microbial metabolism – nutrient balance, metabolically blocked microbes; radiolabelled compounds.

Bioenergetics: **Energy yielding metabolism** – Energy from organic compounds – carbohydrates – aerobic (EMP, HMP, ED, TCA, ET) in prokaryotes and eukaryotes; complete oxidation.

Energy from visible radiation – photosynthesis in eukaryotes, blue-green algae, bacteria.

UNIT III

Anaerobic fermentation – alcoholic fermentation, propionic acid fermentation, formic acid fermentation**. Energy from inorganic compounds** - ET in chemolithotrophs - ammonia oxidation by members of Genus Nitroso group, nitrite oxidation by Nitro group of genera., production of reducing power in chemolithotrophs - Oxidation of molecular hydrogen by Hydrogenomonas species Ferrous and sulfur/sulfide oxidation by Thiobacillus species**.**

UNIT IV

Stress physiology --- effect of oxygen toxicity ,pH, osmotic pressure, heat shock etc on bacteria Adaptations in thermophiles, halophiles ,alkaliphiles ,acidophiles , Extremophiles – adaptations & significance in biotechnology

UNIT V

Enzymes and co –enzymes: IUBMB classification and nomenclature of enzymes, active site, Lock and key Machanism and induced fir hypothesis, Enzyme kinetics- enzyme inhibition: Reversible – Competitive, Noncompetitive, uncompetitive, Irreversible inhibition.

Reference Books:

- Brock Biology of Microorganisms (14thEdition) Michael T. Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley,David A. Stahl, January 12, 2014; ISBN-10:0321897390; ISBN-13:978-0321897398
- Microbial Physiology, 4thEdition Michael P. Sector),Albert G. Moat(Editor),John W. Foster(Editor),Michael P. Spector
- Chemical microbiology –An introduction to microbial physiology –AH Rose, Butterworth, London
- The Physiology and Biochemistry of Prokaryotes-4thEdition David White,James Drummond,Clay Fuqua,December 2011
- Chemical microbiology –An introduction to microbial physiology –AH Rose, Butterworth, London
- The Physiology and Biochemistry of Prokaryotes-4thEdition David White, James Drummond,Clay Fuqua,December 2011

Course Outcome

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

CO 1 - Describe the types of the growth factors involved in the microbial communities.

CO 2 - Apply the theoretical knowledge to solve the problems in microbial metabolic engineering.

CO 3 - Describe how the microbes can regulate their structure and metabolism in response to environmental stimuli.

CO 4 - Design, carry out, and report on lab experiments in microbial metabolism and microbial regulation.

PAPER IV: 18MBTAC04 MICROBIAL GENETICS AND RECOMBINANT DNA TECHNOLOGY

COURSE OBJECTIVES:

- To improve the knowledge on genomic structure of microbes
- Recalling the molecular genetics concepts and genetic transformation.
- To familiarize recombinant DNA technology
- To learn gene cloning strategiesand expression analysis
- Applications of recombinant DNA technology in various fields

UNIT I

Origin of Molecular Genetics-Structure of DNA-Mutations-Luria and Delbruck's Fluctuation Test-Spontaneous mutations-nonsense, missense, frame-shift mutations-Induced mutagenesis-Physical agents-UV,X-Rays-Chemical agents-NTG, Base Analogues etc., Reversion-AMES Test-DNA Replication-Messelson and Stahl's Experiment-Okazaki's fragment-DNA polymerases-DNA damage-SOS response-DNA repair.

UNIT II

Gene transfer in bacteria-Transformation-discovery and its significance-competence and factors involved-joint transformation and its uses-Conjugation-F+ and F^- nature of *E.coli*-Origin of Hfr and F' strains-Zygotic induction -Chromosome transfer by Hfr - circular nature of *E.coli* DNA -Use of Hfr strains in genetic mapping-Transduction - λ phage and specialized transduction - Generalised transduction-P1 phage-origin of transducing particles-pre zygotic and post zygotic exclusion-Co-transduction-fine structure mapping of genes by P1 transduction-Wu's Formula-Ratio Test, C-value paradox.

UNIT III

Elucidation of genetic code- Benzer, Khorana and Crick's contributions-Triplet nature of the Genetic code and Adaptor hypothesis-Wobble hypothesis- Bacterial translation, Suppression of nonsense, missense and frame-shift mutations-Intragenic and extragenic suppressions of mutations-modern aspects-structure and function relationship-Gene expression-RNA polymerase-σ factors-other accessory transcription factors-small RNAs'-Concept of Gene and operon-Regulation of gene expression- well studied operon models-*lac*, *trp* and *ara* operon

UNIT IV

Birth of r-DNA technology- Restriction enzymes and their role in r-DNA technology-Restriction-modification system methylase,ligase, adaptors, linkers, homopolymer tailing, *E.coli*-Types of restriction enzymes - Plasmid vectors as cloning vehicles-Vectors for protein over expression, protein secretion and controlled expression-

Bacteriophages as cloning vehicles-λ mediated vectors-M13 phage and its use, Cosmids, Phagemids, plasmids, BACS.

UNIT V

Gene Cloning -Purpose – Genomic Library construction-Polymerase chain Reaction (PCR)-Cloning into gram negative, gram positive bacteria and Yeast-Screening of recombinants- α complementation and blue-white selection - Construction of cDNA Library - use of phagemids and Cosmids-DNA sequencing- DNA and RNA hybridization- Southern and Northern blotting-DNA sequencing- Sangers method-Basics of pyrosequencing, next generation sequencing strategies-western blotting for proteins-Semi-quantitative and Real time PCR to quantify gene expression-Yeast two hybrid system-Application of r-DNA technology in human genetics and forensic science-RAPD, RFLP, AFLP, SSCP, Dot and colony blotting.

TEXT BOOKS

1. Principles of Gene Manipulation and Genomics-S.B.Primrose and R.M.Twyman, 2006.John Wiley & Sons Ltd.

2. Molecular Genetics: An introductory narrative, Second Edition - Gunther.S.Stent and Richard Calendar, 2002. CBS Publishers and distributors.

REFERENCE BOOKS

1. A Short Course in Bacterial Genetics: A Laboratory Manual and Handbook for Escherichia coli and Related Bacteria- Jeffrey. H. Miller, 1992.CSHL Press.

2. Fundamental Bacterial Genetics - Nancy Trun and Janine Trempy, 2004. Blackwell publishing 3. From Genes to Genomes: Concepts and Applications of DNA Technology, Second Edition-Jeremy.W.Dale and Malcolm Von Schantz, 2007. John Wiley & Sons Ltd.

COURSE OUTCOMES:

CO 1 - After completing the course, the student should be able to
CO 2 - Explain the processes behind mutations and other genetic changes
CO 3 - Identify and distinguish genetic regulatory mechanisms at different levels
CO 4 - Solve theoretical and practical problems in genetic analysis particularly concerning genetic mapping and strain construction
CO 5 - Plan basic experiments in microbial genetics concerned with recombinant DNA technology
CO 6 - Perform gene cloning and their expression studies using various advance techniques

PRACTICAL I – 18MBTCP1 BASIC MICROBIOLOGICAL TECHNIQUES

1. Media preparation – Liquid and Solid media, Agar deep, slant and plate.
2. Pure culture techniques – Streak plate, pour plate, spread plate, decimal dilution.
3. Motility determination- soft agar inoculation.
4. Enumeration of microorganisms from soil: Bacteria, Fungi and Actinomycetes.
5. Staining: Smear fixation, simple, Gram, acid fast, spore, capsule and negative.
6. Growth curve and Effect of various intrinsic factors such as pH, Temperature on the growth of bacterium-Spectroscopic method
7. Anaerobic culture techniques; Mc Intosh Fildes anaerobic jar, Wright's tube method.
8. IMViC test
9. Hydrogen sulphite test
10. Oxidase test
11. Calalase test
12. Urease test
13. Nitrate reduction test
14. Polymer degradation – Starch, Gelatin, Casein.
15. Carbohydrate fermentation.
16. Observation of mitotic cell division using onion root tips –Demo
17. Micropropagation of ex-plant
18. Isolation of DNA from plant cells
19. Giemsa banding and Karyotyping of chromosomes by lymphocyte culture
20. Animal cell culture – MTT assay and COMET assay

SEMESTER II
PAPER V: 18MBTAC05 IMMUNOLOGY AND IMMUNOTECHNIQUES

Course Objective

- Provide knowledge on the mechanism of action of immune system
- Understanding principle and methodology of various immunological techniques
- Learning the fundamental mechanism behind autoimmune disorders
- Perceiving information on different types of hypersensitive reactions

Scope: This paper imparts information about the structure and function of immune system and the related immunological techniques.

UNIT -1

History and scope of Immunology Lymphoid organs and tissues. Immunity- types-innate and acquire, active and passive, Cell mediated and Humoral Immunity. Hematopoiesis- origin, development and differentiation of immune cells.

UNIT-2

Cells of the immune system: Macrophages, B and T lymphocytes- Activation and types, Dendritic cells, Natural Killer cells, lymphokine activated killer cells, Eosinophils, Neutrophils, Mast cells. Antibody; Production, Primary and Secondary antibody response. Immunoglobulin structure, types and functions. Antigen- types.Haptens, adjuvants, carriers, bacterial, viral and tumour antigens, autoantigens, blood group antigens and Rh factor.

UNIT-3

Antigen-Antibody reactions.Factors governing antigens-antibody interactions; affinity, avidity, valency, cross reactivity.Applications of Immunologicaltechniques- Immunoflourescence, RIA, RAST, ELISA and Flowcytometry. Structure and functions of MHC molecules. Response of B cell to antigen, T cell products.

UNIT-4

The complement systems: Mode of activation and pathways. Transplantation immunology: MLR, HLA Typing. Bone marrow transplantation, organ transplants. Tumor immunology. Cancer of the immune system. Autoimmune disorders and Immunology of infectious diseases – viral, Bacterial and protozoan and Immunodeficiencies.

UNIT-5

Hypersensitivity reactions and types. Immune tolerance and suppression. Immunotheraphy. Hybridoma technology- Monoclonal Antibody production and applications in diagnosis and theraphy.Catalytic antibodies.FACs. Vaccination methods, Vaccine Technology and recombinant vacccines- DNA vaccines and Edible vaccines..

REFEENCES:

1. Kubey, J. 1993. Immunology Freeman and company.
2. Janeway, C.A., Immuno-biology Paul Travers1994.
3. SeemiFarhatBasir., Text Book of Immunology by. First edition. PHI LrarningPvt Ltd, New Delhi.
4. MadhaveeLatha, P., A Text Book of Immunology, First Edition. S.Chand& Company Ltd, New Delhi

Course Outcomes

CO 1 - Able to understand the structure, function, principles and practices outlining various key concepts in immunology.

CO 2 - Equipped to perform various immunological assays

PAPER VI: 18MBTAC06 MOLECULAR PATHOGENESIS AND CLINICAL DIAGNOSIS

COURSE OBJECTIVES:

- Create knowledge on the various groups of causative organism
- Enable the students to know the pathway involved with microbial infections
- Impart information on methods of diagnosis of various diseases.
- Allow them to apply their gained knowledge in controlling the infections

UNIT I

Microbes and parasites: Mile stones in medical Microbiology, Introduction: classification in clinical practices: Bacteria, Fungi, Viruses, Protozoa, Helminthes, Arthropods and Prions; Host-parasite relationship, Infectious disease process-modes of transmission, factors predisposing to microbial pathogenicity, stages, pathological patterns, virulence and infectivity

UNIT II

Invasion of Microbes: Adsorption to the potential sites, membrane trafficking in eukaryotic cells, routes of invasion and selection of intracellular niche, bacterial manipulation of host cell cytoskeleton, nosocomial infection; Normal microflora of human body; Bacterial toxins and virulence genes; Strategies of host defense.

UNIT III

Methods of Disease Diagnosis: Sampling site-normally sterile and with normal microflora; Sample collection-method of collection, transport and processing of samples, antibiogram,interpretation of results; Diagnostic methods- cultured: microscopy, microbial antigen; non-cultured: PCR based microbial typing: Eubacterial identification based on 16s rRNA sequences-Amplified ribosomal DNA Restriction analysis(ARDRA)-Culture independent analysis of bacteria-DGGE and TRFLP; Molecular diagnosis of fungal pathogens based on 18s rRNA sequences; Detection of viral pathogens through PCR; Monoclonal antibodies.

UNIT IV

Diagnosis of Infections : Bacteria- Staphylococcus, *Streptococcus*, Coliforms, *Salmonella*, *Shigella*, *Vibrio* and *Mycobacterium Bacillus anthracis, Treponema pallidum.* Fungi-Major fungal diseases, Dermatophytoses – Blastomycosis, Cryptococcosus, Histoplasmosis Candidiosis and Aspergillosis DNA and RNA Viruses- DNA virus- Herpes, Adeno, Pox, RNA virus-Rota virus, Influenza virus, Rhabdo Virus, Hepatitis Virus and Retro Virus.

UNIT V

Diagnosis of Infections Protozoan diseases-Amoebiosis, Malaria, Trypnosomiosis, Leishmaniasis; Helminthis diseases-*Fasicola hepatica* and *Ascaris lumbricoides*; Filariasis and Schistomiosis.

TEXT BOOKS

1. Medical Microbiology (1997). Edited by Greenwood. D, Slack. R and Peutherer. J, ELST Publishers
2. Henry‟s Clinical Diagnosis and Management by Laboratory Methods (2007). Mepherson.

REFERENCES

1. Bailey and Scott‟s Diagnostic Microbiology (2002). Betty A. Forbes, Daniel F. Sahm, Alice S. Weissefeld, Ernest A Trevino. Published by C.V. Mosby
2. Fundamental of Molecular Diagnostics (2007). David E. Bruns, Edward R. Ashwood, Carl A. Burtis. Sauders group.
3. Molecular Diagnostics for the Clinical Laboratorian 2nd ed. (2006). W.B.Coleman. Humana Press.

COURSE OUTCOMES:

CO1: Able to Identify the type of specimen to be collected and collection methods for an infection
CO2: Able identify the causative organism by culture based and molecular analysis
CO3: Capable to design research work for control of the infection at molecular level

PAPER VII: 18MBTAC07 FOOD BIOTECHNOLOGY

Course Objectives

- To impart knowledge about the various areas related to food science as a discipline
- To encode the importance of the role of microorganisms in food industries both in beneficial and harmful ways
- To develop an understanding of food composition,principles of preservation, new product development, food quality and analysis and food safety laws.

UNIT I

Fermentation products: Dairy products: - Production of starter cultures; Cheese - principles of cheese making. Cheddar Cheese, Swiss Cheese, Surface ripened Cheeses; Mold ripened Cheeses. General principles of manufacture of Yogurt, acidophilus milk, Kefir, Koumiss. Fermented foods: Soy sauce, Miso, Sufu, Natto, Idli, fermented fish products. Fermented vegetables: Sauerkraut, pickles, Olives. Fermented sausages.

UNIT II

Distilled beverages: Alcohol, wine, brandy and beer.

Food additives: Production of additives - organic acid (acetic acid, lactic acid and citric acid), amino acids (glutamic acid, lysine, threonine, arginine and histidine), food flavourants and pigments.

UNIT III

Food spoilage and public health: *Staphylococcal, Salmonellosis, E.coli,* Botulism, aflatoxin and amine production; food spoiling enzymes; Deterioration of foods- vegetables, meat, poultry, sea food and fruits.

Food preservation: Principles of food preservation – methods of preservation: Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere); Chemical (Sodium benzoate Class I & II); Biological: Probiotics and bacteriocins.

UNIT IV

Indicator organisms – Direct examination – culture techniques – enumeration methods – plate – Viable & Total Count; Alternative methods – Dye reduction tests , electrical methods , ATP determination: Rapid methods, immunological methods – DNA / RNA methodology – Laboratory accreditation.

UNIT V

Food process technology: Packaging and canning of foods – preparation for packaging, thermal processing of foods: Microwave heating, thermal inactivation of microorganisms, thermal process, evaluations, freezing and thawing of foods. Food process operations: Evaporation - single and multi effect evaporation, dehydration, psychomatric

charts, drying-tunnel, tray, spray, drum, freeze, distillation; food processing aid through biotechnology.

Food sanitation: Good manufacturing practices – Hazard analysis, Critical control points, Personnel hygiene

TEXT BOOKS

1. Industrial Microbiology, 1983, 4th Edition, Prescott and Dunn's, Gerald Reed, AVI Publishing Company Inc. Conneticut.
2. Food Microbiology- Frazier, 1987, Tata McGraw-Hill Education.

REFERENCES

1. Food Biotechnology. 1982. by Knorr, D. Marcel Dekker, New York
2. Biotechnology, 1983, VI-VIII, Rehm, H.J. and Reed,G, Verlag Chemie,Wainheim.
3. Genetic Engineering Applications for Industry, 1981, Paul,J.K.,Noyer Corporation, New Jersey.
4. Fundamentals of Food Process Engineering, 1980, Toledo,R.T., AVI Publishing Co., USA.
5. Food Engineering Operations, 1979, 2nd Edition, Brennan,J.G., Bulters,J.R., Gowelx,N.D and Lilly, A.E.V., Applied Science Publishers.
5. Food Process Engineering, 1977, 2nd Edition, Heldman, D.R., AVI Publishing

Course Outcome

CO 1 - Explain importance of different types of food in balanced diet and diet planning
CO 2 - Differentiate between different nutrient components in food and their role in processing and consumption.
CO 3 - Correlate basic food microbiology with food safety laws and standards.
CO 4 - Apply traditional methods for food preservation in developing a new food product.
CO 5 - Determine food quality by food analysis as per food laws and the their importance in food industry.

PAPER VIII: 18MBTAC08 ENVIRONMENTAL BIOTECHNOLOGY

COURSE OBJECTIVES

- To give information about various pollution sources and preventive measures to control pollution.
- To learn intensive process in various pollution treatments
- Applications of Environmental biotechnology in various industries

UNIT I

Basic concepts ecology: Interaction between environment and biota; Concept of habitat and ecological niches; Limiting factor; Energy flow, food chain, food web and tropic levels; Ecological pyramids and recycling, biotic community-concept, structure, dominance, fluctuation and succession; N.P.C and S cycles in nature. Soil Microbiology-Structure, Types, Physical and Chemical properties-Soil microbes (Types and Enumeration)-Weathering and Humus formation, Soil pollution-Sources.

UNIT II

Aerobiology-Microbial contamination of air-Sources of contamination-Biological indicators of air pollution. Enumeration of bacteria from air, Air sampling devices. Significance of air Microflora, Outline of Airborne diseases (Bacterial - Whooping cough, Diphtheria, Pneumonia; Fungal - Aspergillosis, Cryptococcosis; Viral – Chickenpox, Influenza, Measles), Air sanitation. Air pollution : Types, source, method of sampling, measurement, impact on ecosystem and control. Control of noise and air pollution by biotechnological methods. Gaseous pollutants and odours: General sources, methods of control; fundamentals of adsorption, mechanism of adsorption.Application of adsorption for control of gaseous and odour emission. Noise pollution: Source, measurement, impact on ecosystem and control.

UNIT III

Aquatic Microbiology-Microbiology of water (Aquatic environment-Fresh and Marine)-Water pollution: Impurities in water, water pollution by industrial waste, examination of water, collection of water samples, water analysis – physical, chemical and biological. Assessment of water quality (Chemical and Microbial-indicator organisms) Water treatment processes: Primary treatment, screening, skimming with coagulants, flocculation, filteration, aeration and disinfection; Secondary treatment: Aerobic processes – activated sludge, oxidation ditches, trickling filter, towers, rotating discs, rotating drums, oxidation ponds. Anaerobic digestion, anaerobic filters, Up flow anaerobic sludge blanket reactors; Tertiary treatment: Activated carbon treatment, reverse osmosis and electro dialysis. Water borne pathogens.

UNIT IV

Solid waste management: sewage sludge treatment and utilization, refuse disposal, excreta disposal in unsewered area; composting and vermiculture.; biodegradation of cellulosic and noncellulosic wastes for environmental conservation and fuel; bioaugmentation and biostimulation,bioconversion of cellulosic wastes into protein and fuel; biodegradation of xenobiotics; bioremediation of contaminated soils and waste lands; radioactive product waste disposal.

UNIT V

Effluent treatment – Case studies: Sources of pollution, impact on ecosystem and treatment of following industrial effluents: starch, paper and pulp, tannery, dairy, distillery, oil refineries and pharmaceutical. Microbes in mining, ore leaching, oil recovery, biopolymers, biosurfactants.

TEXT BOOKS

1. Environmental Biotechnology by Alan Scragg.(2005). IInd edition. Pearson Education Limited, England.
2. Environmental Biotechnology by S.N. Jogdand. (1995). Ist edition. Himalaya Publishing House.Bombay.

REFERENCES

1. Wastewater Engineering – Treatment, Disposal and Reuse. Metcalf and Eddy, Inc., Tata McGraw Hill, NewDelhi
2. Environmental chemistry by A.K. De Wiley Eastern Ltd. NewDelhi.
3. Introduction to Biodeterioration by D. Allsopp and k.J. Seal, ELBS/Edward Arnold.

COURSE OUTCOMES:

After completing the course, the student should be able to

CO 1 - Students will be able to understand use of basic microbiological, molecular and analytical methods, which are extensively used in environmental biotechnology.

CO 2 - To combat any pollution problems arising from industries.

PRACTICAL II – 18MBTACP2 ADVANCE MICROBIOLOGICAL TECHNIQUES

1. Wine production
2. Organic acid production – Citric acid – Solid state and submerged fermentation.
3. Isolation of nitrogen fixers – free living, symbiotic, ammonification, nitrification, denitrification.
4. Isolation of Phosphate solubilizers.
5. Isolation of Coliphage.
6. Isolation of Plasmids and chromosomal DNA from microbes.
7. Restriction digestion and ligation of bacterial DNA
8. Preparation of competent cells
9. Gene transfer in bacteria by calcium mediated method and identification of recombinants by antibiotic marker
10. Size determination and fractionation of nucleic acids and proteins – Agarose gel electrophoresis, SDS – PAGE.
11. Identification of food pathogen
12. Estimation of coliforms by MPN in water -Demo
13. Determination of BOD of effluent -Demo
14. Determination of COD of effluent -Demo
15. Biofertilizer production and formulation using *Rhizobium* culture -Demo
16. Biopesticide production and formulation using *Trichoderma viride-Demo*
17. Nano particle synthesis from microbes –Demo
18. Characterisation of nano particles by SEM, XRD and FTIR –Demo

ELECTIVE

ELECTIVE PAPER I: 18MBTGE12A ANIMAL BIOTECHNOLOGY

Objectives:

1. To impart the theoretical knowledge on animal cell and tissue culture techniques.
2. To give a hands-on practical exposure on explants isolation, cell derivation, culturing and maintenance.
3. To enable the learners explore advancements of the field and recent technical updates.
4. To provide the knowledge on various aspects of applications including therapeutics, diagnostics and cell culture based products.

UNIT I

Introduction -History of animal cell culture techniques. Types of animal cell/tissue culture. Advantages and limitations of animal cell culture techniques. Aseptic techniques inside the cell culture laboratory. Biology of cultured cells –Cell adhesion, proliferation, differentiation, cell signaling, energy metabolism and senescence.

UNIT II

Basic requirements for animal cell culture - equipments and culture vessels. Media and supplements- physical, chemical and metabolic functions of different constituents of culture medium; Various media- Complete and defined media, serum and protein free media. Antibiotics in culture media. Media preparation and sterilization.

UNIT III

Establishment of primary culture. Methods of cell disaggregation. Subculture and cell line propagation. Cloning and selection of cultured cells. Cell separation techniques. Cell synchronization. Cryopreservation of cultured cells. Contamination of cultured cells. Large scale production of therapeutic proteins, hormones and vaccines from cultured animal cells.

UNIT IV

Stem cell Biology: Introduction, biology and classification-Unipotent, Pluripotent and Totipotent. Sources of stem cells-embryonic stem cells, embryonic germ cells and adult stem cells (Mesenchymal, Hematopietic, Induced pluripotent stem cells (iPS), Umbilical cord blood cells, Adipose tissue). Stem cells characterization-Genetic markers and membrane markers. Therapeutic applications of stem cells.

UNIT V

Tissue Engineering: Principles, tissue engineering triad – Basic Constitutents (Matix molecules, Ligands, Growth factors, Biomaterials). Tissue engineering bioreactors. Biodegradable polymers in tissue engineering. Therapeutic applications of tissue engineering.

Outcome of the course:

CO 1 - Students would understand and appreciate basic and advanced methods of mammalian and plant tissue culture techniques.

CO 2- The practical exposure would kindle the ideas of students to come up with novel applications of the field.

CO 3 - The technical details would expand the knowledge on the field that would equip the students to implement their views.

TEXT BOOKS

1. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6th Edition- R. Ian Freshney (Wiley Publishing)
2. Animal Cell Culture: A Practical Approach, 3rd Edition -John R. W. Masters (Oxford University Press)
3. Principles of Tissue Engineering, 4th Edition, Robert Lanza, Robert Langer, Joseph P. Vacanti.(Academic Press)
4. Principles of genetic manipulation; Ed. Old and Primrose, 6th Edition. Blackwell science publication.

REFERENCES

1. Methods in cell biology; Volume 57, Animal cell culture methods, Ed. Jennie P. Mather, David Barnes, Academic press.
2. Mammalian cell biotechnology; A practical approach, Ed. M. Butler, Oxford University press.
3. Stem Cells: Scientific Progress and Future Research Directions (http://stemcells.nih.gov/)
4. Essentials of Stem Cell Biology, 2nd Edition - Robert Lanza, John Gearhart, Brigid Hogan, Douglas Melton, Roger Pedersen, E. Donnall Thomas, James Thomson and Sir Ian Wilmut (Academic Press)

ELECTIVE PAPER II: 18MBTGE12B BIOMOLECULAR METABOLISM

Course Objectives:

- To provides information about the significance of biomolecules
- Recalling the fundamental concepts of biochemistry
- To learn the structure and functions of biomolecules

Unit I

Foundations of Biochemistry: Chemical foundations of Biology: pH, pK, acids, bases and buffers, Henderson-Hassel Balch Equation, biological buffer solutions. Concept of free energy:

Unit II

Principles of thermodynamics; Kinetics, dissociation and association constants; energy rich bonds and weak interactions; Coupled reactions; group transfer; biological energy transducers.

Unit III

Aminoacids: Structural features of amino acids, classification of amino acids, peptide linkage, determination of primary structure of polypeptide (N-terminal, C-terminal determination, method of sequencing of peptides), structural classification of proteins, primary, secondary, tertiary, quaternary structures of proteins, protein detection and estimation.

Unit IV

Carbohydrates: Monosaccharides, Disaccharides and Polysaccharides, Glycoconjugates: Proteoglycans, Glycoproteins, and Glycolipids. Carbohydrate metabolism: Glycogenolysis, Gluconeogenesis, interconversion of hexoses and pentoses.

Unit V

Lipids: Classification, chemical nature, properties. Biosynthesis of fatty acids. Oxidation of fatty acids. Storage Lipids, Structural Lipids in Membranes, Lipids as Signals, Cofactors, and Pigments.

Reference Books

- Microbial Biochemistry-2nd Edition - Georges N. Cohen Springer, Feb 2, 2011 – SCIENCE
- Lehninger Principles of Biochemistry by Albert L. Lehninger, David L. Nelson, Michael M. Cox

Course Outcomes:

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

CO 1 - Get a distinct idea about structure and function, synthesis and breakdown of Biomolecules.

CO 2 - Understand metabolic events that occur in cells.

CO 3 - Distinguish the mechanism of regulation associated with these metabolic events.

ELECTIVE PAPER III: 18MBTGE13A PLANT BIOTECHNOLOGY

COURSE OBJECTIVES:

- To understand the basic and latest techniques for in vitro culture of plants.
- Providing advanced knowledge about use of plant biotechnology in breeding and micropropagation techniques.
- To introduce the students to the theory and practice of plant tissue culture and their role from modifying plants in plant biotechnology to the propagation of endangered plants.

Unit – I

Laboratory organization and Techniques in Plant Tissue Culture. Organ culture, root, shoot tip or meristem, ovary, flower and ovule culture and their importance.

Unit – II

Callus culture-principle, protocol and significance, Cell suspension culture – Principle, protocol and its importance. Totipotency, cytodifferentiation and organogenesis – Principle, factors influencing Organogenesis and applications.

Unit – III

Somatic embryogenesis and synthetic seeds – Principle, protocol and importance. Single cell culture, embryo culture – Principle, protocol and applications. Anther and Pollen culture – Principle, protocol, and its significance. Protoplast, isolation, fusion and culture somatic hybridization, chemofusion, electrofusion, important properties of protoplast, somatic hybrids, cybrids – Principle, protocol and importance.

Unit – IV

Somaclonal variation – Causes and significance, plant tissue culture in forestry, micro propagation, clonal propagation production of useful biochemicals – Gene conservation bank – plant tissue culture in biotechnology-commercial aspects of plant tissue culture.

Unit – V

Application of transgenic plants for Biotic Stress tolerance: Herbicide resistance: phosphoinothricin and glyphosate; Insect resistance: *Bt* genes and alpha amylase inhibitor. Disease resistance: chitinase and 1,3-beta glucanase; Virus resistance: coat protein mediated, nucleocapsid gene; Nematode resistanc;. **Abiotic stress:** Drought, cold and salt; Post-harvest losses: long shelf life of fruits and flowers, male sterile lines, RNAi and Reverse genetics; Nutritional enhancement- Golden rice; Edible vaccine.

References:

1. Edwin F. George and Paul Sherington, D. 1984. Plant Propagation by Tissue Culture, Exegetics Ltd., Edington, Westbury, England.
2. Indra K. Vasil, 1980. Cell Culture and Somatic Cell Genetics of Plants. Academic Press Inc., New York.
3. Kalyanakumar De. 1997. An Introduction to Plant Tissue Culture, New Central Book Agency, Calcutta.
4. R.L.M. Pierik, 1987. In vitro culture in higher plants.MartinusNijhoff Publishers, Boston.

COURSE OUTCOMES:

CO 1 - Capable of understanding the totipotency of plants.
CO 2 - Able to identify the cell differentiation.
CO 3 - Able to understand cell and tissue culture contributes to global sustainability.
CO 4 - Abe to develop the graduate capabilities of knowledge ability, comprehension and applications of plants in cell, tissue culture and genetic engineering.
CO 5 - It will also develop the practical skills and confidence of students to successfully perform plant cells and tissues culturing.
CO 6- Capacity to establish commercial plant tissue culture lab.

ELECTIVE PAPER IV: 18MBTGE13B BIOREMEDIATION AND WASTE MANAGEMNT

Course Objective:

1. To impart knowledge on the management of solid and liquid wastes from municipal, industrial sources.
2. To provide the principles of remedial measures of recycling, reuse and wealth from the wastes.
3. To enable the degradation possibilities using biological methods called bioremediation.

UNIT – I:

Waste Classification and Quantification: Solid Waste Management- Sources and Generation of Solid Waste, characterization, composition, classification and disposal strategies. Hazardous Waste Management: Cyanides, Dioxins, Detergents, Plastics, Nylon and Paper. Radioactive Waste management: Sources, half life of radioactive elements, modes of decay. Radioactive waste disposal strategies and its impact of on living organisms.

UNIT - II

Recycling of Wastes – Types – sources – composition of waste – recycling of waste for Industrial, Agricultural and Domestic Purposes. Recycling of metals and reuse, recovery and reduction of paper and plastics. Various Waste Disposal Methods – composting, incineration, pyrolysis. Medical waste disposal strategies.

UNIT – III:

Microbial Activity in Soil and Ground Water. Microorganisms in rock and minerals, Mineral soil and Organic soil. Physiological groups of prokaryotes. Geomicrobial transformations – Biodegradation of carbonates – Biomobilization of silicon, phosphate, nitrogen.

UNIT - IV

Principles of Bioremediation – Rapid growth and Metabolism- Genetic plasticity – Metabolic pathways for the degradation of xenobiotis, hydrocarbons. Biodegradation potential – Bioprocess design, optimization – Microbial removal rates – inherent problems associated with biotreatment studies. Microbiological methodologies – Standard biotreatability protocols – Quantification of biodegradation.

UNIT – V

Aerobic Bioremediation: Bioremediation of Surface Soils: Fate and transport of contaminanats in the Vadose zone – Biodegradation in soil ecosystems – Types of soil treatment systems – Bioreactors. Subsurface Aerobic Bioremedidation: Selection of bioremediation system – in situ Bioremediation – in situ Bioventing – in situ treatment of Harbour Sediments – in situ Lagoon treatment. Bioremediation in fresh water and marine

systems. Anoxic/Anaerobic Bioremediation:– Anoxic/Anaerobic Processes – Fermentation, Degradation of xenobiotic. Anoxic/Anaerobic bioremediation of hydrocarbons, Chlorophenolic compounds, Phenols, Polycyclic Aromatic Hydrocarbons (PAH), Heterocyclic Compounds, Cyanide. Factors influencing anaerobic Bioremediation, Phytoremediation. Legislation, Regulation and Policy - Current Regulations and programs of interest – Hazardous Waste Management Act.

Outcome of the Course:

CO 1 - The course creates awareness about the various wastes and associated risks to living organisms and environment.

CO 3 - Students would understand the methods of hazardous waste disposal strategies and its merits and demerits.

CO 4 - The course would enable the learners to understand the minimal utilization and benefits of waste conversion into useful products.

REFERENCE:

1. Microbial Ecology, IV Ed., Atlast, R.M and Bartha,R.,(2000) Addison Wesley Longman Inc.
2. Bioremediation, Baker,K.H. and Herson,D.S., (1994) McGraw–Hill Inc.
3. Biology of Microorganisms, VII Ed., Brock,T.D., Madigan,M.T. Martinko,J.M. and Parker,J (1994) Prentice Hall, New Jercy.
4. Geomicrobiology, Ehrlich,H.L (1996) Marcel Dekker Inc., New York.
5. Bioremediation – Principles, Eweis,J.B., Ergas,S.J, Change,D.P.Y and Schroeder, E.D (1998) McGraw-Hill Inc.
6. Environmental Engineering, Kiely, G (1998) Irwin/McGraw Hill International, U.K.
7. Hazardous Waste Management, II Ed, LaGrega,M.D.,Buckingham,P.L., and Evans,J.C (2001) McGraw Hill Inc.
8. Microbial Degradation of Xenobiotics and Recalcitrant Compounds, Leisinger, T, Cook,A.M., Hutter,R and Nuesch,J (1981) Academic Press, London.
9. Hazardous Wastes and Solid Wastes, Liu, D.H.F and Liptak,B.G (2000),Lewis Publishers, New York.
10. Microbiology, Pelezar, M.J.Jr., Chan, E.C.S and Kreig,N.R (1993) Tata McGraw Hill, Delhi.
11. Remediation of Petroleum Contaminated Soils – Biological, Physical and Chemical processes, Riser-Roberts, E., (1998) Lewis Publisher, New York.
12. Vadose-Zone and Ground Water Contamination – Assessment, Prevention and Remediation, RusselBoulding, J (1995), Lewis Publishers, Tokyo.
13. Recycling of Crop, Animal and Human Waste in Agriculture, Tandon (1995), McGraw Hill Publishing Co.

SUPPORTIVE PAPER OFFERED

SUPPORTIVE I: MICROBIAL BIOTECHNOLOGY

COURSE OBJECTIVE:

- Empowering Students with knowledge on Microbial products
- Giving insight on Fermentation process

UNIT I

Isolation, Preservation and Maintenance of Industrial Microorganisms. Media for industrial fermentation. Air and Media Sterilization.

UNIT II

Industrial microbiology – microbial synthesis of organic acids (Citric acid), alcohol (ethanol), alcoholic beverages (wine), antibiotics production (penicillin), vitamin(B12) and amino acid(glutamic acid)

UNIT III

Agricultural microbiology: SCP production- mushroom cultivation; Biofertilizers and bioinsecticides;

UNIT IV

Medical microbiology – methods of isolation of pathogenic organisms; vaccine production; Insulin production

UNIT V

Environmental biotechnology – Microbes in waste water treatment, microbial ore leaching and mineral recovery, oil recovery.

REFERENCES:

1. Principles of Fermentation Technology, Stanbury, P.F. and Whitaker, A.,Pergamon Press, Oxford.
2. Manual of Industrial Microbiology and Biotechnology, III edition (1999), Arnold L. Demain and Julian Davies, ASM press, Washington DC
3. Food microbiology, Frazier
4. Industrial Microbiology, Casida
5. Industrial Microbiology, by Creuger and Creuger
6. Medical Microbiology – Ananthanarayanan and Panicker

COURSE OUTCOMES:

CO 1 – Able to deign process condition for production of microbial products
CO 2 – Can perform any fermentation production process

SUPPORTIVE II: FOOD BIOTECHNOLOGY

COURSE OBJECTIVE:

- Give an insight on the role of microorganism in food industries
- Categorize harmful and beneficial microorganism in food industries

UNIT 1

Introduction: Nutritive factors of food constituents – protein, carbohydrates, fats in nutrition, bioavailability of nutrients, stability of nutrients. Microbes as direct food (Single cell protein and Baker's yeast); mycoprotein and yeast extract.

UNIT II

Fermentation products: Dairy products: General principles of manufacture of Cheese and Yogurt; Fermented foods: Soy sauce and Miso; Fermented vegetable: Sauer Krant and pickles. Fermented sausages.

UNIT III

Distilled beverages: Alcohol, wine, brandy and beer; **Food additives:** Production of additives - organic acid (acetic acid), amino acid (glutamic acid), food flavourants and pigments.

UNIT IV

Food spoilage and public health: *Staphylococcal, Salmonellosis, E.coli,* Botulism, aflatoxin.

Food preservation: Principles of food preservation – methods of preservation: Physical (irradiation, drying, heat processing, chilling and freezing, high pressure and modification of atmosphere); Chemical (Sodium benzoate Class I & II); Boilogical: Probiotics and bacteriocins.

UNIT V

Food process technology: Canning, Microwave heating, thermal inactivation of microorganisms, freezing and thawing of foods. Food process operations: Evaporation - single and multi effect evaporation, dehydration, psychomatric charts; drying-tunnel, tray, spray, drum, freezeing; distillation; food processing aid through biotechnology.

REFERENCES

1. Industrial Microbiology, 1983, 4th Edition, Prescott and Dunn's, Gerald Reed, AVI Publishing Company Inc. Conneticut.
2. Food Biotechnology. 1982. by Knorr, D. Marcel Dekker, New York

COURSE OUTCOME:

CO 1 – Can apply techniques for prevention of food spoilage.
CO 2 – Can imply the knowledge for use of beneficial organism in food industry

SUPPORTIVE III: CLINICAL MICROBIOLOGY

COURSE OBJECTIVE:

- Providing information on types of infections and their epidemiology
- Imparts knowledge on host defense and immune system
- Understanding the preventive measures towards infection

UNIT 1

Infection and immunity: General principles of infection, antigens, antibodies, antigen – antibody reactions, complement system.

UNIT II

Pathogenic/Parasitic organisms: Bacterial, viral and protozoal infections of the gastrointestinal system, nervous system, lung, liver, and eye; sexually transmitted diseases, skin infections, zoonoses, arthropod borne diseases. Transmission and spread of diseases – disease epidemiology.

UNIT III

Control and prevention of infections: Drugs and antibiotics, drug resistance, mycobacteria, leprosy and malarial parasite – importance, life cycle, spread and control. Control of vectors – mosquito control – biotechnological approaches.

UNIT IV

Vaccines : Types and methods of action. Biotechnological approaches to disease control and vaccine production. Genetic disorders and gene therapy.

UNIT V

Biochemical changes due to infections: Blood test and tissue analysis. Isolation and identification of organisms from tissue samples. Disease detection – conventional and molecular techniques.

REFERENCES

1. Immunology,Roitt,I.M., Brestoff and Male D.K., 1996.
2. Text book of microbiology, C.J.K. Panicker.
3. Molecular biotechnology, Glick.
4. Clinical microbiology, Ananthanarayanan.

COURSE OUTCOME:

CO1: Able to predict the epidemiology of disease

CO2 : Will know the different types of infections and their causative organism

CO3: Can identify the detection and preventive measures of an infection