

**VIVEKANANDHA
COLLEGE OF ARTS AND SCIENCES FOR WOMEN**

**ELAYAMPALAYAM, TIRUCHENGODE (Tk.), NAMAKKAL (Dt.).
(Affiliated to Periyar University, Approved by AICTE,
Re-Accredited with 'A' Grade by NAAC)
Recognized under section 2(f) &12(B) of UGC ACT 1956,
An ISO 9001:2008 (Certificate institution)**



DEPARTMENT OF MICROBIOLOGY

B.Sc MICROBIOLOGY

SYLLABUS & REGULATIONS

FOR CANDIDATES ADMITTED FROM

2016 - 2017 ONWARDS

UNDER AUTONOMOUS & CBCS PATTERN

VIVEKANANDHA EDUCATIONAL INSTITUTIONS

Angammal Educational Trust

**A
U
T
O
N
O
M
O
U
S**

SCHEME OF CURRICULUM - UG MICROBIOLOGY

Se m	Subject code	Pa rt	Course	Subjects	Hrs / wee k	Cre dits	Int. mar ks	Ext. marks	Tot · ma rks
I	14U1LT01	I	Languag e-I	Tamil-I	6	3	25	75	100
	14U1LH0 1			Hindi-I					
	14U1LM0 1			Malayalam-I					
	14U1LE01	II	English-I	Foundation English-I	6	3	25	75	100
	14U1BCA 01	III	Allied-I	Biochemistry-I	5	3	25	75	100
				Allied Practical-I	3	-	-	-	-
	14U1MBC 01	III	Core-I	Fundamentals of Microbiology	5	5	25	75	100
				Major Practical-I	3	-	-	-	-
14U1VE0 1	IV	VAE	Value education – Yoga	2	2	25	75	100	
			Total		30	16	125	375	500
II	14U2LT02	I	Languag e-II	Tamil-II	6	3	25	75	100
	14U2LH0 2			Hindi-II					
	14U2LM0 2			Malayalam-II					
	14U2LE02	II	English-II	Foundation English-II	6	3	25	75	100
	14U2BCA 02	III	Allied-II	Biochemistry-II	5	3	25	75	100
	14U2MBC 02	III	Core-II	Microbial Physiology	5	5	25	75	100
	14U2BCA P01	III	Allied	Allied Practical-I	3	3	40	60	100
	14U2MBC P01	III	Core	Major Practical-I	3	4	40	60	100
	14U2ES0 1	IV	EVS	Environmental Studies	2	2	25	75	100

				Total	30	23	205	495	700
III	14U3LT03	I	Language-III	Tamil-III	6	3	25	75	100
	14U3LH03			Hindi-III					
	14U3LM03			Malayalam-III					
	14U3LE03	II	English-III	Foundation English-III	6	3	25	75	100
	14U3MAA11	III	Allied-III	Bio-Statistics	6	3	25	75	100
	14U3MBC03	III	Core-III	Microbial Genetics	4	5	25	75	100
				Major Practical-II	3	-	-	-	-
	14U3BTN01	IV	NMEC-I	Concepts of Biotechnology	2	2	25	75	100
14U3MBS01	IV	SBEC-I	Microbial Diversity	3	3	25	75	100	
			Total	30	19	150	450	600	
IV	14U4LT04	I	Language-IV	Tamil-IV	6	3	25	75	100
	14U4LH04			Hindi-IV					
	14U4LM04			Malayalam-IV					
	14U4LE04	II	English-IV	Foundation English-IV	6	3	25	75	100
	14U4CSA04	III	Allied-IV	Computer applications in Biology	5	3	25	75	100
	14U4MBC04	III	Core-IV	Immunology and Immunotechnology	4	5	25	75	100
	14U4CSAP02	III	Allied	Allied Practical-II	2	3	40	60	100
	14U4MBCP02	III	Core	Major Practical-II	2	4	40	60	100
	14U4MBS02	IV	SBEC-II	Microbes As Extremophiles	3	3	25	75	100
	14U4BTN02	IV	NMEC-II	Applied Biotechnology	2	2	25	75	100
			Total	30	26	230	570	800	
V	14U5MBC05	III	Core-V	Medical Bacteriology	6	5	25	75	100
	14U5MBC	III	Core-VI	Medical Virology	5	5	25	75	100

	06								
	14U5MBC 07	III	Core-VII	Medical Parasitology & Mycology	5	5	25	75	100
	14U5MBE 01	III	Elective- I	Recombinant Technology	5	5	25	75	100
	14U5MBS 03	IV	SBEC- III	Entrepreneurial Microbiology	3	3	25	75	100
				Practical-III	6	-	-	-	-
				Total	30	23	125	375	500
VI	14U6MBC 08	III	Core- VIII	Soil and Environmental Microbiology	6	5	25	75	100
	14U6MBC 09	III	Core-IX	Food and Dairy Microbiology	5	5	25	75	100
	14U6MBE 02	III	Elective- II	Quality Assessment in Microbiology	5	5	25	75	100
	14U6MBE 03	III	Elective- III	Industrial and Pharmaceutical Microbiology	5	5	25	75	100
	14U6MBS 04	IV	SBEC- IV	Haematology and Blood banking	3	3	25	75	100
	14U6MBC P03	III	Core	Practical-III	-	4	40	60	100
	14U6MBC P04	III	Core	Practical-IV	6	5	40	60	100
	14U6EX0 1	-	-	Extension activity	-	1	-	-	-
				Total	30	33	205	495	700
Overall Total					180	140	1040	2760	3800

NON MAJOR ELECTIVE COURSE- SKILL ORIENTED

1. Bioinstrumentation
2. Bioinstrumental Techniques
3. Microbiology - I
4. Microbiology - II

FUNDAMENTALS OF MICROBIOLOGY

Objectives:

- To study the history and scope of microbiology
- To gain knowledge about microscopes.
- To understand staining techniques.
- To study culture media and culture techniques.
- To gain knowledge about sterilization techniques.

The students will be able to demonstrate appropriate laboratory skills and techniques and control of infectious microbes. Students will gain knowledge on the distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures.

UNIT – I

(12 Hours)

History and Scope of Microbiology – The discovery of Microorganisms – Spontaneous generation – Contributions of Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister and Alexander Fleming. Classification systems -Whittaker’s five kingdom - six kingdom and eight kingdom approach.

UNIT – II

(12 Hours)

Microscopy - Bright field - Dark Field - Phase contrast and Fluorescence microscope. Electron Microscope -Specimen preparation -TEM and SEM.

UNIT – III

(12 Hours)

Staining Methods – Stains and its types - Preparation of specimen for microscopy- Hanging drop technique - Simple staining, Differential staining – Gram’s, Acid fast and Special staining methods - Endospore and Capsule staining.

UNIT – IV

(12 Hours)

Cultivation of Microbes – Culture media - Definition, classification based on composition, consistency and functional types. Cultivation of anaerobes - Pyrogallol and Gas pak method - Pure culture isolation techniques.

Sterilization and Disinfection – Physical and Chemical methods of sterilization Antibiotics - Source – Classification - Mode of action - Antimicrobial resistance - Tests for sensitivity to antimicrobial agents - Sterility testing.

Text Books

1. Pelczar MJ, Chan ECS and Kreig NR (2008). **Microbiology**. 5th Edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.
2. Dubey RC and Maheswari DK (2005). **A Textbook of Microbiology**, Revised Multicolour Edition. S Chand and Company Limited, New Delhi.
3. Sullia S.B and Santhanam S (2005). **General Microbiology**. 2nd Edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books

1. Willey, J.M., Sherwood, L and Wool Verton C.J. (2011). **Prescott's Microbiology**. 8th edition, McGraw Hill, New York.
2. Jacquelyn G. Black (2005). **Microbiology: Principles and Explorations**. 6th Edition. John Wiley and Sons Australia Limited.
3. Kathleen Park Talaro (2009). **Foundations in Microbiology: Basic Principles**, 7th Edition. McGraw-Hill Higher Education

MICROBIAL PHYSIOLOGY

Objectives:

- To study the ultrastructure of bacterial cell.
- To gain knowledge about microbial nutrition.
- To understand about microbial transport.
- To impart knowledge on microbial metabolism.
- To gain knowledge about the use of energy in biosynthesis.

The contents of microbial physiology will help the students to understand the basic anatomy of vegetative and spore forms of microorganisms, microbial nutrition, mechanism of nutrient uptake, metabolism and energy yielding processes.

UNIT - I

(12 Hours)

Anatomy of Prokaryotes – Shape and arrangement - Structure and functions of cell wall - Cilia - Flagella -Slime layer - Capsule - Pili - Cytoplasmic Membrane and Cytoplasmic inclusions – Sporulation and its mechanism.

UNIT - II

(12 Hours)

Microbial Nutrition - Common nutrient requirements - Nutritional types of microorganisms – Synchronous growth- Batch and continuous culture - Factors affecting growth – Measurement of Microbial growth - Growth curve.

UNIT – III

(12 Hours)

Microbial Transport - Structure and organization of membrane, fluid mosaic model of membrane. Methods of transport of solutes in bacteria - different mechanism of active transport, passive diffusion and facilitated diffusion.

UNIT – IV

(12 Hours)

Microbial Metabolism - Aerobic respiration – Glycolysis, Krebs cycle and Electron Transport System - Anaerobic respiration – Fermentation and its types – Homolactic and Heterolactic fermentation. Photosynthesis- Oxygenic and Anoxygenic.

UNIT – V

(12 Hours)

Use of Energy in Biosynthesis – Fixation of CO₂ by Autotrophs – The Calvin cycle –Synthesis of sugars – Synthesis of aminoacids – Synthesis of purines and pyrimidines.

Text Books

1. Pelczar MJ, Chan ECS and Kreig NR (2008).**Microbiology**. 5th Edition,Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.
2. Ram Reddy S and ReddySM (2005). **Microbial Physiology**. 1st Edition.Scientific Publishers, India.
3. Meenakumari S (2006). **Microbial Physiology**. 1st Edition.MJP Publishers, A unit of Tamilnadu Book House, Chennai.

Reference Books

1. Moat G, John W Foster and Michael P Spector (2002). **Microbial Physiology**.4th Edition. Wiley-Lis, Inc., New York.
2. Daniel R. Caldwell (2000).**Microbial Physiology and Metabolism**. 2nd Edition.Star Publishing Company.
3. Willey, J.M., Sherwood, L and Wool Verton C.J.(2011).**Prescott's Microbiology**. 8th edition, McGraw Hill, New York.

SEMESTER –II
14U2MBCP01
Credit - 4

CORE PRACTICAL - I
Total Number of Hours: 45
3 Hours/Week

CORE- PRACTICAL-I

1. Safety measures in Microbiology laboratory
2. Cleaning of Glassware.
3. Sterilization principles and methods - moist heat - dry heat and filtration methods.
4. Handling and maintenance of microscope.
5. Morphology of microorganisms: Morphological variations in algae, Morphology of fungi.
6. Staining techniques: Smear preparation, Simple staining, Gram's staining, Acid fast staining.
7. Motility demonstration: Hanging drop preparation.
8. Micrometry.
9. Media preparation- Liquid media, solid media, Agar slants, Agar plates. Basal, enriched, selective media preparation.
10. Pure culture techniques: Streak plate, pour plate, spread plate and serial dilution methods.
11. Cultural characteristics of microorganisms: Growth on different media, growth characteristics and description.
12. Physiological characteristics: IMViC test.
13. Antibiotic sensitivity testing: Disc diffusion test

References

1. Sundararaj T (2005). **Microbiology Laboratory Manual**. AswathySundararaj, Perungudi, Chennai.
2. Dubey RC and Maheshwari DK (2002). **Practical Microbiology**. S Chand and Co. Ltd., New Delhi.
3. Aneja KR (2010). **Experiments in Microbiology, Plant Pathology and Biotechnology**. New Age International (P) Limited Publishers.
4. Harold J Benson (2002). **Microbiological Applications: Laboratory manual in General Microbiology**. 8thEdition. Mcgraw-Hill, Boston.
5. James G Cappuccino and Natalie Sherman (2005). **Microbiology: A Laboratory manual**.7th Edition, Pearson Education, Inc.

MICROBIAL GENETICS

Objectives:

- To gain knowledge about DNA and RNA.
- To understand DNA replication in prokaryotes.
- To impart knowledge on transcription in prokaryotes.
- To study the mechanism of genetic exchange.
- To gain knowledge about mutation.

The contents of this course will help students to understand DNA and RNA as the genetic material. Students will understand the central dogma of the cell, mechanism of genetic exchange and molecular basis of mutation.

UNIT-I

(12 Hours)

Genetics - Historical introduction – DNA as a genetic material - Discovery of DNA structure - physical & chemical properties - Circular and super helical DNA - RNA as genetic material. Prokaryotic Genomes - Physical organization of bacterial genomes (Structure of the bacterial nucleoid)

UNIT-II

(12 Hours)

DNA replication in prokaryotes – Meselson and Stahl experiment - Mechanism & enzymology of replication – theta replication & rolling circle replication. Genetic recombination: requirements, molecular basis, genetic analysis of recombination in bacteria.

UNIT-III

(12 Hours)

Transcription in prokaryotes – genetic code – translation of proteins – regulation of gene expression in prokaryotes – Molecular mechanism of gene regulation in prokaryotes - Transcriptional regulation in prokaryotes (inducible and repressible system, positive regulation and negative regulation); Operon concept – lac and trp operons.

UNIT-IV

(12 Hours)

Mechanism of genetic exchange: Plasmid, Types of plasmids (F Plasmid, R plasmid, Col plasmid) - Copy number and compatibility, Episomes. Transposable elements (Insertion sequence and transposons) DNA mediated Transformation; Conjugation (Cointegrate Formation and Hfr Cells, F' Plasmid); Transduction (Generalized transduction, Specialized Transduction)

UNIT-V

(12 Hours)

Molecular basis of spontaneous and induced mutations (physical and chemical mutagenic agents), types of mutation: point, frameshift, lethal, conditional lethal, inversion and deletion, null mutation, reversion of mutations, intra and intergenic suppression mutations. Mutagenicity testing - Ames Test. Systems that safeguard DNA. DNA methylation and DNA repair mechanisms - excision, mismatch, SOS, photoreactivation, recombination repair and glycosylase system.

Text Books

1. David Freifelder (2005). Molecular Biology. 2nd Edition. Narosa Publishers, New Delhi.
2. Verma PS and Agarwal VK (2006). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S.Chand & Company Ltd., New Delhi.

Reference Books

1. Friedberg EC, Walker GC, Siede W (2006). **DNA repair and mutagenesis**. ASM press, Washington DC.
2. Benjamin Lewin (2000). **Genes VII**. 7th Edition. Oxford University press, Inc.
3. Maloy SR, Cronan JE, Freifelder D (1994). **Microbial Genetics**. Jones and Bartlett Publishers.

SEMESTER –III
14U3MBS01
Credit - 3

SBEC-III
Total Number of Hours: 24
2 Hours/ Week

MICROBIAL DIVERSITY

UNIT-I **(5 Hours)**

Microbial Systematics – Evolution, Phylogeny, Microbial Taxonomy and Classification - Haeckel, Whittaker and Carl Woese system, Numerical Taxonomy and Molecular based classification.

UNIT-II **(5 Hours)**

Bacterial diversity – General characteristics of bacteria and classification - Bergeys' Manual of Systematic Bacteriology (up to order level), Actinomycetes and Cyanobacteria.

UNIT-III **(5 Hours)**

Archaeal diversity – Taxonomic and functional groups – Thermophiles, Halophiles, Methanogens, Biodiversity of fungi – based on morphology and taxonomical classification.

UNIT-IV **(5 Hours)**

Algal diversity – Green algae, Diatoms and Golden brown algae, Dinoflagellates. Biodiversity of Protozoa - Life cycle of cellular and acellular slime molds.

UNIT-V **(4 Hours)**

Viral diversity - General properties - Structure - Classification – Plant Viruses, Animal Viruses and Bacteriophage.

Text Books:

1. Dubey RC and Maheswari DK (2005). **A Textbook of Microbiology**, Revised Multicolour Edition. S Chand and Company Limited, New Delhi.
2. Stanier RY, Ingraham JL, Wheelis ML and Painter PR (1987). **General Microbiology**. 5th Edition, MacMillan Education Ltd., London.
3. Pelczar MJ, Chan ECS and Kreig NR (2008). **Microbiology**. 5th Edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.

Reference Books:

1. Willey, J.M., Sherwood, L and Wool Verton C.J. (2011). **Prescott's Microbiology**. 8th edition, McGraw Hill, New York.
2. Ronald M Atlas (1997). **Principles of Microbiology**. 2nd Edition. Wm. C. Brown Publishers.

SEMESTER –IV
14U4MBC04
Credit - 5

CORE-IV
Total Number of Hours: 60
5 Hours/ Week

IMMUNOLOGY & IMMUNOTECHNOLOGY

Objectives:

1. To gain knowledge about the cells and organs of the immune system.
2. To impart knowledge on immunity and vaccines.
3. To gain knowledge about antigens and immunoglobulins.
4. To impart knowledge on antigen-antibody interactions.
5. To understand about autoimmunity and hypersensitivity.

This course aims to introduce the host defense mechanism and host-microbial interactions. It focuses on the essential concepts of immune factors and the immune system. It elaborates further on the immunotechniques and its applications, an emerging advancement of immunology.

UNIT- I

(12 Hours)

History and scope of immunology, Haematopoiesis: Formation of blood cells. Cells and organs of the immune system – Granulocytes - phagocytes, mast cells, reticular and endothelial cells, macrophage function, dendritic cells, Lymphocytes – formation, subsets. Organs - Primary lymphoid organs – Thymus – structure, Bursa - function Secondary lymphoid organs – structure and function of spleen and lymph node, Mucosa Associated Lymphoid Tissue; response of secondary lymphoid organs to antigen, lymphatic system and lymph circulation

UNIT- II

(12 Hours)

Immunity– Types - Innate Immunity– Specific and Non-specific -Acquired Immunity. Cell mediated immunity and Humoral immunity. Herd Immunity, Immunisation schedule, Vaccines - Types – Definition.

UNIT- III

(12 Hours)

Antigens– Definition, Principle of an Antigen and its types - Immunoglobulins - Structure of basic unit and classification, Theories of antibody formation – instructive, selection theory and clonal selection theory. Hybridoma Technology and its Applications.

UNIT- IV

(12 Hours)

Antigen-Antibody Interactions - Antibody affinity and avidity, Cross reactivity. Precipitation reactions - in fluid and in gel. Agglutination reactions - Blood grouping and Rh Typing, Haemagglutination, HAI, Bacterial agglutination, Passive agglutination. Immunoelectrophoresis, Immunofluorescence techniques – Direct, Sandwich and Indirect, ELISA, Biotin-Avidin system, RIA, Western blotting technique, Flowcytometry and Immunoelectron microscopy

UNIT –V

(12 Hours)

Autoimmunity - different autoimmune diseases - Pernicious Anaemia and Rheumatoid Arthritis. Transplantation and Tumour immunology - Hypersensitivity - Immediate and Delayed Type Hypersensitivity - Gell and Coomb's classification of Hypersensitivity – outline of the mechanisms with examples.

Text Books:

1. Annadurai B (2008). **A Textbook of Immunology and Immunotechnology**. 1st Edition. S Chand & Co. Ltd., New Delhi.
2. Chakraborty P (2003). **A Text Book of Microbiology**. 2nd Edition. New Central Book Agency (P) Ltd, Kolkata.
3. Arti Kapil (2013). **Ananthanarayan and Paniker's Text Book of Microbiology**. 9th Edition, Orient Blackswan Private Limited.

Reference Books:

1. Kindt TJ, Goldsby RA, Osborne BA and Janis Kuby (2007). **Kuby Immunology**. WH Freeman and Company, New York.
2. Tizard IR (1995). **Immunology: An Introduction**. 4th Edition. Saunders College Publishers, USA.
3. Riott IM (1988). **Essentials of Immunology**, ELBS and Black Well Scientific Publishers, London.

MICROBES AS EXTREMOPHILES

Objectives:

The course enables the students to understand the various mechanism involved to overcome the extreme environments, their special adaptation and applications with special emphasis on microbes in space.

UNIT-I (8 hours)

Extremophiles – Definition –Adaptative Mechanism of Extremophiles – Thermophiles, Hyperthermophiles, Psychrophiles and Alkalophiles-Survival at extreme environments – Hot Springs and Acid Springs -Importance of Extremophiles.

UNIT-II (7 hours)

Archaeobacteria – Characteristics - Dead Sea environment – Halophiles – Adaptation and Applications – Barophiles –Adaptation and Applications. Special reference with microbes under deep sea - Mariana trench.

UNIT-III (7 hours)

Microbes growing in toxic environments – acid mine drainage – coal desulphurization- cyanides and radio isotopic habitats.

UNIT-IV (7 hours)

Geo-microbial processes – Physiological aspects of Methanogenesis, Sulphur reduction, Nitrate reduction and Phosphate reduction – Anoxygenic photosynthesis

UNIT-V (7 hours)

Space Microbiology – Life Detection Methods – Evidence of metabolism and Photosynthesis, Monitoring of Astronauts microflora.

Text Books

1. Prescott LM, Harley JP and Klein DA (2005). **Microbiology**. 6th edition, International edition, McGraw Hill.
2. GeetaSumbali and Mehrotra RS (2009). **Principles of Microbiology**. 1st Edition, Tata McGraw Hill (P)Ltd., New Delhi.

Reference Books

1. Johari BN (2000). **Extremophiles**. Springer Verlag, New York.
2. Kushner DS (1978). **Microbial life in extreme environments**. Academic Press Inc., New York.
3. Robert F Boyd (1984). **General Microbiology**. Times mirror/Mosby college publishers.

SEMESTER –IV
11U4MBCP02
Credit - 4

CORE- PRACTICAL-II
Total Number of Hours: 45
3 Hours/Week

PRACTICAL-II
MICROBIAL GENETICS
AND
IMMUNOLOGY & IMMUNOTECHNOLOGY

1. Purification of chromosomal DNA - Confirmation of nucleic acid by spectral study.
2. Effect of UV radiations to study the survival pattern of *E.coli*. Repair mechanisms in *E.coli* (Dark and photoreactivation)
3. Isolation of antibiotic resistant mutants by chemical mutagenesis.
4. Ampicillin selection method for isolation of auxotrophic mutant by gradient plate technique.
5. Extraction and Purification of RNA from *S. cerevisiae*.
6. Isolation of Coliphage from sewage
7. Transformation (competent cell preparation)
8. Collection of venous blood from human and separation and preservation of serum/plasma
9. Blood grouping & Rh Typing
10. Agar gel diffusion – Ouchterlony's method
11. Counter immuno electrophoresis
12. Latex agglutination test- RA Test, CRP Test, ASO Test.
13. Widal tube and slide agglutination technique
14. Flocculation test – RPR test
15. Enzyme Linked Immunosorbent Assay (ELISA)

References:

1. Sambrook J and Russell DW (2001). **Molecular Cloning - A laboratory manual**. 3rd Edition. Cold Spring Laboratory Press, New York.
2. Surzycki S (2000). **Basic Techniques in Molecular Biology**.. Springer-Verlag, New York.
3. Riott IM (1988). **Essentials of Immunology**, ELBS and Black Well Scientific Publishers, London.
4. Kindt TJ, Goldsby RA, Osborne BA and Janis Kuby (2007). **Kuby Immunology**. WH Freeman and Company, New York.
5. Chapel H and Halbey M (1986) **Essentials of Clinical Immunology**. ELBS, London.
6. Weir DM, Steward J (1993). **Immunology**. 7th Edition. ELBS, London.
7. Ausubel FM (1998). **Current Protocols in Molecular Biology**. Vol. 1 & 2. John Wiley & Sons Inc.

SEMESTER –III
14U3MBN01
Credit - 2

NMEC- I
Total Number of Hours: 24
2 Hours /Week

NMEC – BIOINSTRUMENTATION

Objectives:

- To gain knowledge about laboratory management and quality control.
- To study the recent advancements in microscopy.
- To impart knowledge on basic instruments in microbiology.
- To study the different types of centrifuges.
- To understand spectroscopic techniques.

The course emphasizes on the basics of laboratory, its requirements and rules. It also gives an understanding about the recent advancements in microscopy, principle and the operation of the basic equipments used in the microbiology/clinical laboratory.

UNIT – I

(5 Hours)

Laboratory – Definition – Functions - Types of laboratories - Basic requirements of a microbiology laboratory – Basic rules of a microbiology laboratory – Universal Work Precautions - Laboratory safety - Laboratory management and Quality control.

UNIT – II

(5 Hours)

Microscopy - Advanced Microscopy - Basic principles and Types – Handling, Care and maintenance - Electron microscopy – Digital camera imaging systems in TEM, Atomic Force Microscopy, Laser Confocal Microscopy.

UNIT – III

(4 Hours)

Autoclave - Basic principle, Instrumentation, Operating mechanism, Types, applications, Hot air oven, Laminar air flow, Incubator, Water bath and pH meter.

UNIT – IV

(5 Hours)

Centrifuge – Sedimentation principle, Relative centrifugal force, Sedimentation coefficient, factors affecting sedimentation velocity, Centrifuge rotors, Types of centrifuges, Ultracentrifuge - Preparative and Analytical – Centrifugation – Types - Differential and Density gradient centrifugation

UNIT – V

(5 Hours)

Spectroscopy – Absorption spectroscopy - Beer Lambert's Law – Principle, Operating mechanism and applications of Colorimeter, Spectrophotometer and Spectrofluorimeter.

Text Books

1. Praful K Godkar and Darshan P Godkar (2006). **Text book of Medical Laboratory Technology**. Bhalani Publishing House, Mumbai.
2. Arora CK and Prakash M (1998). **Laboratory instrumentation**. Anmol Publications Pvt. Ltd., New Delhi.

Reference Books

1. Keith Wilson and John Walker (1994). **Principles and Techniques of Practical Biochemistry**. 5th Edition, Cambridge University Press, New York.
2. Rodney Boyer (2000). **Modern Experimental Biochemistry**. 3rd Edition, Addison Wesley Longman, San Francisco.
3. Webster JG (2004). **Bioinstrumentation**. University of Wisconsin, John Wiley & Sons, Inc. U K.

14U4MBN02
Credit - 2**Total Number of Hours: 24**
2 Hours/Week**NMEC – BIOINSTRUMENTAL TECHNIQUES****Objectives:**

- To impart knowledge on chromatographic techniques.
- To understand electro chemical techniques.
- To study electrophoretic techniques.
- To gain knowledge about blotting techniques.
- To impart knowledge on radioisotopic techniques.

The course helps the students to understand the basic and the principles of chromatographic, electrophoretic, blotting and radioisotopic techniques. It also emphasizes on the latest advancements such as nanosensors. This course will help the students in research with the all the basic skills to handle the instruments.

UNIT I**(5 Hours)**

Chromatographic Techniques – Preparation, Packing of columns, Adsorption, Partition, Ion-exchange, Affinity, Gel filtration chromatography - Paper, Thin layer, and HPLC , GC techniques and their applications.

UNIT II**(4 Hours)**

Electro Chemical techniques – Biosensors – Introduction - Applications – Advantages and Disadvantages, Construction and mode of operation of Biosensor – Transducers - Classification of Biosensors – Types of Biosensors – Cell based biosensors - Enzyme based biosensors – Immune biosensors – Nucleic acid biosensor- Nanosensors - Biochips - Lab on a chip (LoC).

UNIT III**(5 Hours)**

Electrophoretic Techniques – Basic principles and their applications – Factors influencing the rate of migration of biomolecules – Electrophoretic apparatus - Agarose gel electrophoresis – SDS PAGE - Densitometer.

UNIT IV**(5 Hours)**

Blotting techniques – Introduction, Principle, Types - Southern, Western and Northern blotting technique - Instrumentation and Protocol – PCR – Instrumentation of

Thermocycler and its applications.

UNIT V

(5 Hours)

Radio isotope techniques - Radioactive labeling, Measurement of Radioactivity - Autoradiography, GM counter, Scintillation counter - Radiation Dosimeter – Fricke dosimeter.

Text Books

1. Palanivel P (2004). **Analytical Biochemistry & Separation techniques**, 3rd Edition, 21st Century Publications, Palkalai Nagar, Madurai.
2. Asokan P (2001). **Analytical Biochemistry - Biochemical Techniques**. 1st Edition, Chinna Publications, Vellore, Tamil Nadu.
3. Arora CK and Prakash M (1998). **Laboratory instrumentation**. Anmol Publications Pvt. Ltd., New Delhi.

Reference Books

1. Rodney Boyer (2000). **Modern Experimental Biochemistry**. 3rd Edition, Addition Wesley Longman, San Francisco.
2. John GWebster (2004). **Bioinstrumentation**. University of Wisconsin, John Wiley & Sons, Inc. U K.
3. Keith Wilson and John Walker (1994). **Principles and Techniques of Practical Biochemistry**. 5th Edition, Cambridge University Press, New York.

NMEC – MICROBIOLOGY – I

Objectives:

- To study the history and scope of microbiology.
- To gain knowledge about light and electron microscopes.
- To impart knowledge on bacterial anatomy and staining techniques.
- To study the types of culture media.
- To understand sterilization techniques.

The course enables the students to understand the history and scope of microbiology. It also gives an understanding about the basic concepts of microbiology which includes microscopy, structure of bacteria, bacterial growth and sterilization techniques.

UNIT – I

(5 Hours)

History & Scope of Microbiology - Introduction - Contributions of various scientists to Microbiology - Louis Pasteur, Antony Von Leuwenhoek, Robert Koch, Schroder and Von Dush, Schwann, Joseph Lister, John Tyndall, Edward Jenner, Alexander Fleming.

UNIT -II

(5 Hours)

Microscopy - Bright field microscope, Dark field microscope, Phase contrast microscope, Fluorescent microscope and Electron microscope – TEM & SEM.

UNIT – III

(4 Hours)

Basic Structure of Bacteria – Gram positive and Gram negative bacteria. Stains and staining procedure - Types of staining - simple, differential and special staining – Fungal staining techniques – Lactophenol cotton blue staining and KOH mount.

UNIT – IV

(5 Hours)

Culture media – Definition – Types - composition – Media preparation – Basal, Differential, Selective, Transport and Anaerobic culture media.

UNIT – V

(5 Hours)

Sterilization – Definition – Methods - Types of agents - Physical agents - Chemical agents.

Text Books

1. Pelczar MJ, Chan ECS and Kreig NR (2008). **Microbiology**. 5th Edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.
2. Dubey RC and Maheswari DK (2005). **A Textbook of Microbiology**, Revised Multicolour Edition. S Chand and Company Limited, New Delhi.
3. Sullia S.B and Santhanam S (2005). **General Microbiology**. 2nd Edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books

1. Kathleen Park Talaro (2009). **Foundations in Microbiology: Basic Principles**, 7th Edition. McGraw-Hill Higher Education
2. Stanier RY, Ingraham JL, Wheelis ML and Painter PR (1987). **General Microbiology**. 5th Edition, MacMillan Education Ltd., London.
3. Gerard J Tortora, Berdell R Funke, Christine L Case (2010). **Microbiology: An Introduction**. 10th Edition, Pearson Benjamin-Cummings Publishing Company.

SEMESTER –IV
14U4MBN04
Credit - 2

NMEC-II
Total Number of Hours: 24
2 Hours/ Week

NMEC – MICROBIOLOGY – II

Objectives:

- To study the culture techniques.
- To gain knowledge about soil microorganisms and their interactions.
- To impart knowledge on food spoilage and preservation.
- To understand the pathogenesis, prevention and control of diseases.
- To gain knowledge about water borne diseases.

The course enables the students to understand the applications of microbiology in various fields such as agriculture, food and dairy, medical microbiology and environmental microbiology.

UNIT –I (5 Hours)

Culture techniques – Methods - Streak plate, Pour plate, Spread plate. Cultivation of anaerobes – Preservation of cultures.

UNIT –II (4 Hours)

Agricultural Microbiology - Types of soil microorganisms –Symbiotic & Non symbiotic microorganisms. Nitrogen fixation - Microbial interactions – Types of associations - Rhizosphere, Phyllosphere, Mycorrhiza.

UNIT –III (5 Hours)

Food and Dairy Microbiology - Introduction - Sources of food contamination - Microbes involved in spoilage - Methods in food preservation - food poisoning – botulism. Bacterial flora of milk – Detection of bacteria in milk.

UNIT – IV (5 Hours)

Medical microbiology – Infection – Definition – Types – Mode of disease transmission – sources, Factors influencing pathogenesis – Disease cycle, Control of disease and prophylaxis.

UNIT – V (5 Hours)

Environmental microbiology - Introduction - Indicator organisms - Detection of water quality tests. Water borne diseases - Cholera, Typhoid, Polio virus, Hepatitis B Virus.

Text Books

1. Pelczar MJ, Chan ECS and Kreig NR (2008). **Microbiology**. 5th Edition, Tata McGraw Hill-Hill Education Pvt. Ltd., New Delhi.
2. Dubey RC and Maheswari DK (2005). **A Textbook of Microbiology**, Revised Multicolour Edition. S Chand and Company Limited, New Delhi.
3. Sullia S.B and Santhanam S (2005). **General Microbiology**. 2nd Edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books

1. Stanier RY, Ingraham JL, Wheelis ML and Painter PR (1987). **General Microbiology**. 5th Edition, MacMillan Education Ltd., London.
2. Kathleen Park Talaro (2009). **Foundations in Microbiology: Basic Principles**, 7th Edition. McGraw-Hill Higher Education
3. Gerard J Tortora, Berdell R Funke, Christine L Case (2010). **Microbiology: An Introduction**. 10th Edition, Pearson Benjamin-Cummings Publishing Company.

MEDICAL BACTERIOLOGY

Objective:

- To study the pathogenesis, laboratory diagnosis and antimicrobial sensitivity testing.
- To gain knowledge about the diseases caused by Gram positive and Gram negative cocci.
- To impart knowledge on the diseases caused by Gram positive bacilli.
- To understand the diseases caused by Gram negative bacilli.
- To study the diseases caused by acid fast bacilli, spirochetes and intracellular microbes.

The course deals with importance of microorganisms in human health. Students will study the important diseases caused by bacterial pathogens with reference to etiology, pathogenesis, clinical features, laboratory diagnosis and prevention.

UNIT- I

(12Hours)

Normal microbial flora of human body – Infection – Types, Source, Modes of Transmission, Mechanism of bacterial pathogenesis – Laboratory diagnosis of infectious diseases – Antibiotic Sensitivity Test, Antibacterial drugs and mechanism of action.

UNIT- II

(12 Hours)

Staphylococcus aureus - *Streptococcus pyogenes* - *Streptococcus pneumoniae*, *Neisseria gonorrhoeae* - *Neisseria meningitidis*,

UNIT- III

(12 Hours)

Corynebacterium diphtheriae - *Bacillus anthracis* - *Clostridium tetani*- *Clostridium perfringens* – *Clostridium botulinum*

UNIT- IV

(12 Hours)

Escherichia coli - *Klebsiella pneumoniae* - *Proteus* species - *Salmonella typhi* – *Shigella dysenteriae* – *Pseudomonas aeruginosa* - *Vibrio cholerae* - *Campylobacter jejuni* – *Aeromonas hydrophila*.

UNIT- V

(12 Hours)

Mycobacterium tuberculosis - *Mycobacterium leprae* - *Treponema pallidum* – *Leptospira interrogans* - *Mycoplasma* – *Rickettsiae* – *Chlamydiae*.

Text Books:

1. Arti Kapil (2013). **Ananthanarayan & Jayaram Paniker's Text book of Microbiology**. 9th edition, Orient Longman Limited, Chennai.
2. Chakraborty P (2003). **A Text book of Microbiology**. 2nd edition, Published by New Central Book Agency (P) Ltd., Kolkata.

Reference Books:

1. Jawetz E and JL Melnic (2001). **Medical Microbiology**, 22nd edition, Tata Mc Graw-Hill, New Delhi.
2. David Greenwood CB and Richard (2002). **Medical Microbiology**. 22nd edition, Tata Mc Graw- Hill, New Delhi.
3. Monica Cheesbrough (2003). **District Laboratory Practice in Tropical Countries**. Part 1 and 2. Low-Price edition, Cambridge University Press.

MEDICAL VIROLOGY

Objective:

- To study the virus classification, structure and characteristics.
- To gain knowledge about medically important DNA viruses.
- To impart knowledge on the medically important RNA viruses.
- To understand the arthropod borne viruses.
- To study the viral diagnostic techniques.

The course deals with importance of viruses in human health. Students will study important diseases caused by viruses with reference to morphology, cultivation, pathogenesis, clinical features, laboratory diagnosis and prevention.

UNIT- I **(12 Hours)**

General characteristics of viruses - Viral multiplication - Cultivation of viruses - Viral assay - Classification and nomenclature of viruses - Viroids - Prions - Antiviral agents

UNIT- II **(12 Hours)**

Variola and Vaccinia viruses - Herpes simplex virus - Varicella Zoster virus - Adenoviruses - Hepatitis A virus - Hepatitis B virus - Cytomegalo virus - Epstein Barr virus - Rhino virus

UNIT- III **(12 Hours)**

Polio virus - Human immunodeficiency virus - Dengue virus - Influenza virus - Mumps virus- Measles virus - Rubella virus - Rotavirus

UNIT- IV **(12 Hours)**

Arthropod borne viruses - Rhabdo virus - Human Papilloma Virus - Papova virus - bacteriophages – Types, structure and its uses

UNIT-V **(12 Hours)**

Viral diagnosis - Immunodiagnosis - Haemagglutination and Haemagglutination Inhibition test – Complement fixation test - ELISA - Viral vaccines

Text Books:

1. Arti Kapil (2013). **Ananthanarayan & Jayaram Paniker's Text book of Microbiology**. 9th edition, Orient Longman Limited, Chennai.
2. Saravanan P (2006) **Virology**. 1st edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.

Reference Books:

1. Luria SE, Darnell JE, Baltimore D and Compare A (1978). **General Virology**, 3rd edition, John Wiley and Sons, New York.
2. Morag C and Timbury MC. (1994). **Medical Virology**. 10th edition, Churchill Livingstone, London.

MEDICAL PARASITOLOGY AND MYCOLOGY

Objective:

- To study the basics of parasites, classification, transmission, cultivation and examination.
- To gain knowledge about the diseases caused by protozoan parasites.
- To impart knowledge on the diseases caused by nematodes, trematodes and cestodes.
- To understand the fungal classification, diagnosis, cultivation and antifungal agents.
- To study the superficial, cutaneous, sub cutaneous, systemic and opportunistic mycoses.

The course deals with importance of parasitic and fungal disease in human health. Students will study important diseases caused by parasite and fungi with reference to morphology, cultivation, pathogenesis, clinical features, laboratory diagnosis and prevention.

UNIT- I

(12 Hours)

Introduction to medical parasitology – Classification - Transmission of parasites – pathology and pathogenesis – Common diagnostic methods in parasitology - Examination of faeces for ova and cyst – Concentration methods – Blood smear examination of parasites – cultivation of parasites.

UNIT- II

(12 Hours)

Entamoeba histolytica - *Giardia lamblia* - *Trichomonas vaginalis* - *Leishmania donovani* - *Trypanosoma brucei* - *Plasmodium falciparum* – *Plasmodium malariae* – *Balantidium coli*

UNIT- III

(12 Hours)

Ascaris lumbricoides - *Ancylostoma duodenale* - *Schistosoma haematobium* - *Taenia solium* – *Taenia saginata* - *Diphyllobothrium latum* - *Enterobius vermicularis*- *Trichuris trichiura* – *Wuchereria bancrofti*

UNIT- IV

(12 Hours)

Classification of medically important fungi - Laboratory diagnosis of fungal diseases - Collection and examination of fungal specimens - Isolation and identification of fungi - Staining of fungi - KOH, LCB, PAS, H&E, GMS - Cultivation of fungi - Antifungal drugs - Antifungal susceptibility test .

UNIT- V

(12 Hours)

Classification of Mycoses - *Tinea nigra* - *Piedra* - *Dermatophytoses* - *Mycetoma* - *Histoplasmosis* - *Cryptococcosis* - *Candidiasis* - *Aspergillosis* - *Mycotoxinoses*.

Text Books:

1. Parija S.C. (2013) **Text book of Medical Parasitology**. 4th edition. All India Publishers and Distributors, New Delhi.
2. Chatterjee (1986). **Medical Parasitology**. Tata McGraw Hill, New Delhi.
3. Jagdish Chander (2012). **Text book of Medical Mycology**. 3rd edition. Mehta Publishers, New Delhi.

Reference Books:

1. David T. John and William A Petri Jr (2006). **Markell and Voge's Medical Parasitology**. 9th edition. Saunders, An imprint of Elsevier.

RECOMBINANT TECHNOLOGY

Objectives:

- To understand various nucleic acid isolation techniques.
- To impart knowledge on nucleic acid amplification and hybridization techniques.
- To study basic techniques in genetic engineering.
- To gain knowledge on recombinant tools in medicine.
- To study the basics in bioinformatics.

The course enables the students to understand nucleic acid isolation, polymerase chain reaction, gel electrophoresis, blotting techniques and gene therapy. The legal and ethical issues are covered to understand the applications and consequent issues of genetically modified organisms.

UNIT – I (12 hours)

Nucleic acid isolation - Isolation of DNA – Genomic DNA – Plasmid DNA - Phage DNA - RNA – mRNA purification - Concentration and quantification of nucleic acids

UNIT – II (12 hours)

PCR - Basic features, optimization of PCR parameters, Types of PCR and its applications – Nucleic acid hybridization: principles and applications - preparation of probes

UNIT – III (12 hours)

Electrophoresis of DNA - Pulse field gel electrophoresis (PFGE), SDS-PAGE, Blotting techniques (Southern, Northern and Western), RAPD, RFLP and DNA Fingerprinting

UNIT – IV (12 hours)

Site directed mutagenesis - types and its application. Gene therapy - types and methods - somatic and germ line - Gene targeting - Antisense therapy - principle and its applications. Genetically engineered microorganisms (GEMOs) - Risk assessment.

UNIT –V (12 hours)

Introduction to Bioinformatics – Goals – Scope - Applications – Biological databases – Public databases – Information retrieval from biological databases - Sequence alignment - Pair wise sequence alignment - Multiple sequence alignment - Gene prediction- methods - Gene finding tools - Analysis and Annotation tools – Gene finding programs - Phylogenetic analysis

Text Books:

1. Brown T.A (2010). **Gene cloning and DNA analysis**. 6th edition. Wiley-Blackwell.
2. Jogdand S.N (2009). **Gene Biotechnology**. Himalaya publishing house (P) Ltd., New Delhi.
3. Satyanarayana. U (2006). **Biotechnology**. Books and Allied (P) Ltd., Kolkata.
4. K.Mani and N.Vijayaraj (2002). **Bioinformatics for Beginners**. 1st edition. Kalaikathir Achchagam, Coimbatore.

Reference Books:

1. Glick B.R and Pasternak J.J (2010). **Molecular Biotechnology: Principles and applications of recombinant DNA**. ASM press. Washington, DC.
2. David W Mount (2005). **Bioinformatics-Sequence and Genome analysis**, 2nd edition. Cold Spring Harbor Laboratory Press, NY.

ENTREPRENEURIAL MICROBIOLOGY

Objectives:

- To understand the basic concepts of entrepreneurship and become a young women entrepreneur.
- To gain business opportunities on mushroom cultivation.
- To expand systemic knowledge on different composting technology.
- To increase the comprehension on various biotechnological approaches to establish successful enterprises.
- To understand different financial agencies supporting entrepreneurship.

The course deals with the study of designing, launching and running a new business using potential microorganisms. Entrepreneur implies qualities of leadership, initiative and innovation in new venture designing of small scale business like production of mushroom, biocompost, vermicompost, biofertilizer and biopesticides.

UNIT I

Evolution of the concept of Entrepreneur – Characteristics – Functions and types of Entrepreneur – Entrepreneurship – Role of entrepreneurship in economic development – Women entrepreneurs – Problems of women entrepreneurs – Factors affecting entrepreneurial growth.

UNIT II

Mushroom cultivation: Edible mushroom – Morphology, Nutritional and medicinal value – Preparation of spawn, types of spawning – Preparation of substrate - Casing – harvesting – storage and marketing - Mushroom diseases and its management – value added products – Soup, Omlette, Samosa, Noodles, Pickles and Curry.

UNIT III

Composting - types of composting – aerobic and anaerobic, Drilospheres – Biology and ecological classification of earthworm – Physical and chemical effects of earthworm on soil, Vermicomposting - species employed, methods and types of production – preparation of vermiwash – Field application and crop response, Storage and marketing of composts.

UNIT IV

Biofertilizer – Rhizobium, BGA, Azolla, VAM – bioinoculum, mass production, field application and crop response – Biopesticide – bacteria and fungi. Production of SCP – *Spirulina* and Yeast – Herbal sale and marketing.

UNIT V

Finance to Entrepreneurs – Commercial banks, funding agencies – TNSCST, UGC, DST, ICMR, CSIR, and DBT. Project proposal writing – selection, formulation and financial plan - Project report preparation and submission.

Text Books

1. Khanka S.S (2003). **Entrepreneurial development**. 3rd edition. S.Chand & Company, New Delhi.
2. Kanniyar.S and Ramaswamy K (1980). **A Handbook of Edible Mushrooms**. Today's and Tomorrow's Printers, New Delhi.
3. Kale Radha D (1998). **Earthworm: Cinderella of organic farming**. Prism Books Pvt. Ltd., Bangalore.
4. Subba Rao, N.S. (1993). **Biofertilizers in Agriculture and Forestry**. 3rd edition. Oxford and IBH publication Co. Pvt. Ltd., New Delhi

Reference Books

1. Shukla M.B (2007). **Entrepreneurship and small business management**. 7th edition. Kitab Mahal publication, Allahabad.
2. Vasant Desai (2001). **Dynamics of Entrepreneurial Development and Management**. 4th edition. Himalaya Publishing House, New Delhi.
3. Chang S.T and Hayes W.A (1978). **Biology and cultivation of mushrooms**. Academic Press, New York.

SOIL AND ENVIRONMENTAL MICROBIOLOGY

Objective:

- To study the physico-chemical and microbiological properties of soil.
- To gain knowledge about the biogeochemical cycles and biofertilizer.
- To impart knowledge on microbial interactions and plant pathology.
- To understand the microbiology of air and water.
- To study the microbiology of sewage and sewage treatment methods.

The course focuses on the concepts of soil and environmental microbiology such as biogeochemical cycles, major plant diseases caused by bacteria, fungi and viruses, biofertilizers and microbiology of air, water and sewage.

UNIT I

(12 Hours)

Introduction to soil microbiology – Physical and chemical properties of soil -Types and significance of soil microbes – Bacteria, Fungi, Actinomycetes, Protozoa, Nematodes and Viruses. Factors affecting microbial population

UNIT II

(12 Hours)

Biogeochemical cycles – Carbon, Nitrogen, Phosphorous and sulphur - Mechanism of nitrogen fixation - Biofertilizer – Rhizobium, Azotobacter and Cyanobacteria – Mass cultivation, field study and its applications

UNIT III

(12 Hours)

Microbial interactions – neutralism, commensalism, synergism, mutualism and parasitism. Interaction of microbes with plants – Rhizosphere, Phyllosphere and Mycorrhizae. Plant Pathology – symptoms, disease cycle and its control measures - Bacterial - Citrus canker, Fungal - Wilt of Cotton and Tikka leaf spot of groundnut, Viral – TMV

UNIT IV

(12 Hours)

Microbiology of air & water – Enumeration of bacteria from air – Air sampling devices – Air sanitation. Assessment of drinking water quality – water standards - indicator organisms – water purification – Waterborne diseases and their control measures

UNIT V

(12 Hours)

Microbiology of sewage - chemical and biochemical characteristics of sewage – BOD, COD - Sewage treatment – primary, secondary and tertiary treatment - Solid waste management

Text Books:

1. Mishra R.R (2004). **Soil Microbiology**. CBS Publishers & Distributers, New Delhi.
2. Subba Rao (1999). **Soil Microbiology**. 4th edition. Oxford and IBH publishing Co (P) Ltd, New Delhi.
3. Joseph C Daniel (1999). **Environmental aspects of Microbiology**. 2nd edition. Bright Sun Publications, Chennai.

Reference Books:

1. Rangaswami.G and Bagyaraj D.J. (2009). **Agricultural Microbiology**.2nd edition. PHI Learning Pvt. Ltd., New Delhi.
2. Ralph Mitchell and Ji Dong Gu (2010). **Environmental Microbiology**. 2nd edition. Wiley-Blackwell, New Jersey

FOOD AND DAIRY MICROBIOLOGY

Objective:

- To study the microorganisms involved in food spoilage and food preservation.
- To gain knowledge about the microbiology of food and food products.
- To impart knowledge on food borne diseases and food poisoning.
- To understand the production of fermented foods.
- To study the production of dairy products.

The course deals with the microorganisms causing food spoilage, its prevention and control. It also focuses on production of fermented foods and dairy products. It covers the food borne diseases of public health significance, food hygiene and food control regulations.

UNIT I (12 Hours)

Food Microbiology – Introduction - Types of microorganisms in food spoilage, Source of contamination - Factors influencing microbial growth in food. Food preservation- principles – high temperature – low temperature – food additives – modern food preservation techniques.

UNIT II (12 Hours)

Microbiology of food and food products - Contamination, spoilage and preservation of cereals and cereal products, Vegetables and fruits, meat and meat products – fish and other sea foods, egg and poultry.

UNIT III (12 Hours)

Food borne diseases, Food poisoning – *Staphylococcus*, *Clostridium*, *Escherichia coli* and *Salmonella* infections, Protozoan infections, Mycotoxins and viral food borne diseases.

UNIT IV (10 Hours)

Food fermentation – Types and methods of fermentations – Classification of fermented foods - Bread, wine and beer

UNIT V (14 Hours)

Dairy Microbiology - Micro flora of milk - Milk borne diseases – Quality testing of milk – MBRT and Resazurin test. Preservation of milk, Fermented dairy products –Yoghurt, Kefir, Kumiss and cheese - Food control agencies and its regulations.

Text Books:

1. Adams M.R and Moss M.O (2008). **Food Microbiology**, 2nd Edition, Royal Society of Chemistry.
2. Frazier W.C and Westhoff D.C (2013). **Food Microbiology**, 5th edition, Tat McGraw Education, New Delhi.

Reference Books:

1. James M Jay, Martin J Loessner and David A Golden (2006). **Modern Food Microbiology**, 7th edition, Springer Science and Business Media, New York.
2. Richard K. Robinson (2005). **Dairy Microbiology Hand book: The Microbiology of Milk and Milk Products**. 3rd edition, John Wiley and Sons, New York.

INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

Objective:

- To gain knowledge about screening techniques and strain improvement.
- To study about different types of bioreactors.
- To know about industrial production of enzymes and antibiotics.
- To understand the production of fermented foods.
- To study the quality control of pharmaceutical products.

The course is oriented towards the industrial applications and production of useful products using microorganisms. The students will know the industrial aspects of microbiology such as screening techniques, preservation methods, strain improvement, fermentor, upstream and downstream processing and fermented microbial products. Quality control and assay of the pharmaceutical products are also focused in this paper.

UNIT- I (12 hours)

Introduction to industrial microbiology - Industrially important microorganisms - Screening techniques - Primary and Secondary - Preservation of cultures - Strain improvement - Development of inoculums – Production media – Industrial sterilization.

UNIT- II (12 hours)

Industrial Fermentor - Components of fermentor – Types of bioreactors –Types of fermentor instrumentation – Fermentor and use - Scale up of fermentation - Upstream processing - Down Stream Processing – Recovery and Purification of intracellular and extracellular products.

UNIT- III (12 hours)

Industrial production of enzymes – α amylase - Organic acid - citric acid, lactic acid and acetic acid - Aminoacid – Lysine - Vitamin B12 - Microbiological production of antibiotics - Penicillin

UNIT- IV (12 hours)

Types of pharmaceutical products - Antimicrobial agents - Bioassay of antimicrobial agents – Contamination, spoilage and preservation of pharmaceutical products – Sterilization of pharmaceutical products - Microbiological quality control - Sterility test- Pyrogen test- Toxicity test- Carcinogenicity test

UNIT -V

(12 hours)

Drug delivery systems - Drug distribution in body, Bio-availability- Adverse drug reaction and drug interaction. Drug discovery - Phases of drug discovery - Clinical studies: phase I, phase II, phase III and phase IV of clinical trials - Bioprospecting - Extraction, purification and characterization of bioactive molecules from natural resources

Text Books:

1. Patel A.H (2011). **Industrial Microbiology**. 2nd edition. Published by Mac Millan Publishers India Ltd., Chennai.
2. Cassida L.E (1996). **Industrial Microbiology**. New Age International Publishers, Chennai.
3. Purohit S.S, Saluja A.K and Kakrani H.N (2004), **Pharmaceutical Microbiology**, 1st edition, Agrobios (India), Jodhpur.

Reference books:

1. Pepler H.J and Perlman D (1979). **Microbial Technology**. Vol.1 and II. 2nd edition. Academic Press, New York.
2. Stanbury P.F, Whitaker A and Hall S.J (1995). **Principles of Fermentation Technology**. 2nd edition. Pergamon Press, New York.

HAEMATOLOGY AND BLOOD BANKING

Objective:

- To gain knowledge about the blood cells.
- To study hematological diseases.
- To impart knowledge on hematological tests.
- To gain knowledge about immunohematology.
- To study blood banking and blood transfusion.

The course will enable the students to develop an understanding on the role of the clinical haematology and haemostasis in the study of human health and disease by introducing the theoretical principles and practical applications of a range of biomedical procedures used in the haematology laboratory for the diagnosis of human disease. It also discusses about the basic principles and concepts in the blood banking and blood transfusion.

UNIT-I

(7 hours)

Introduction to Haematology – Blood – Components and its function - Haematopoietic system of the body – Development of Blood corpuscles - Erythropoiesis – Leukopoiesis – Thrombopoiesis

UNIT-II

(7 hours)

Haematological diseases – Anaemia - Types of Anaemias – Iron deficiency anaemia – Haemolytic disease of the new born – Infectious Mononucleosis – Multiple myeloma – Parasitic infections of blood – Leukaemia - classification.

UNIT-III

(7 hours)

Routine haematological tests – Introduction – Collection of blood – Anticoagulants - Complete Blood Cell count (CBC) – Determination of Haemoglobin by Sahli's method – Cynamethaemoglobin method – RBC count – WBC count - Differential count – Determination of ESR.

UNIT-IV

(7 hours)

Haemostasis and Blood Coagulation – Mechanism of coagulation – Determination of Bleeding time and Clotting time – Immunohaematology – Human blood group systems – ABO grouping and other blood group systems – Rh Typing .

UNIT-V

(8 hours)

Blood banking and Blood transfusion – Screening of blood donors – Preservation and storage of donated blood - Cross matching – Blood transfusion – HLA typing - Transfusion transmitted diseases – Transfusion reaction.

Text Books:

1. Drew Provan (2009). **ABC of Clinical Haematology**, 3rd edition. BMJ books
2. Hoffbrand A.V, Pettit J.E and Moss P.A.H (2001). **Essential Haematology**. 2nd edition. Blackwell Science, New York.

References:

1. Denise M Harmening (2012). **Modern Blood Banking and Transfusion Practices**. 6th edition. F A Davis Company, Philadelphia.
2. **Transfusion Medicine Technical Manual** (2003). 2nd edition. DGHS, Ministry of Health and Family Welfare, Govt. of India,
3. Peter Delves, Seamus Martin, Dennis Burton (2006). **Roitt's Essential Immunology**. 11th edition. Wiley-Blackwell, New York.

QUALITY ASSESSMENT IN MICROBIOLOGY

Objectives:

1. To gain knowledge about quality assurance in microbiological labs
2. To study the quality assurance in sterilization and disinfection.
3. To understand the role of quality assessment in diagnostic procedures
4. To understand the quality assessment of disposal.
5. To gain knowledge about management of laboratory hazards.

The course deals with quality assurance in microbiology laboratory. It covers designing of microbiology laboratory, quality assessment of instruments, diagnostic kits, preservation of microbial cultures and management of laboratory hazards.

UNIT – I (12 hours)

Quality assurance – Introduction and overview – Definition. Designing of microbiology laboratory – Control of quality – Applications.

UNIT – II (12 hours)

Quality assessment of equipment, chemicals, glass wares and laboratory environments – Quality management – Maintenance of records and reports.

UNIT- III (12 hours)

Quality assurance in sterilization and disinfection - Preservation of stock cultures, media and diagnostic kits – Quality control of media and stains.

UNIT- IV (12 hours)

Quality assessment of disposal – decontaminated matters and other biological effluents – Quality management in transportations of cultures. National control of biologicals – Biological references and standards.

UNIT – V (12 hours)

Good laboratory practices – Management of laboratory hazards and knowledge in first aid procedures.

Text Books:

1. Lisa Anne Shimeld and Anne T Rodgers (1999). **Essentials of Diagnostic Microbiology**. 1st edition. Delmar Cengage Learning, New York.
2. Rajesh Bhatia (2000). **Quality Assurance in Microbiology**. CBS publishers and Distributors Pvt. Ltd., New Delhi.
3. Ram Narain (2006). **Twelve Management Skills for Success**. Viva Books, New Delhi

Reference Books:

1. Mandal S.K (2007). **Total Quality Management - Principles and Practice**. 1st Edition. Vikas Publishing House Pvt. Ltd.-Noida

PRACTICAL - III

- 1. Isolation tests for the identification of unknown pathogens**
 - a) Gram's staining
 - b) Hanging drop technique
 - c) Catalase test
 - d) Coagulase test
 - e) Oxidase test
 - f) IMViC test
- 2. Identification of Fungal Specimens**
 - Direct Microscopy – KOH and Lacto phenol preparations.
- 3. Identification of Yeast - Germ tube, Gram Staining and Negative staining**
 - (a) *Candida* spp.
 - (b) *Cryptococcus* spp.
- 4. Serological tests: Sero diagnosis of various viral diseases.**
 - ELISA – HBV and HIV.
- 5. Wet Mount examination of stool for parasites.**
- 6. Estimation of worm burden in stool.**
 - Floatation technique
 - Sedimentation technique
- 7. Isolation of Chromosomal and plasmid DNA**
- 8. Separation and quantification of DNA by Agarose gel electrophoresis.**

References:

1. Dubey R.C and Maheshwari D.K (2002). **Practical Microbiology**. 1st edition. S. Chand Co. Ltd., New Delhi.
2. Cappuccino, J. and N. Sherman (2002). **Microbiology: A Laboratory Manual**. 6th edition. Pearson Education Publication, New Delhi.
3. Collee, J.C., Duguid, J.P, Fraser A.C and Marimon B.P (1996). **Mackie and McCartney, Practical Medical Microbiology**. 14th edition. Churchill Livingstone, London.
4. Holt, J.S., N.R. Krieg, P.H.A. Sneath and S.S.T. Williams (1994). **Bergey's Manual of Determinative Bacteriology**. 9th edition. Williams and Wilkins, Baltimore.

PRACTICAL – IV

1. Enumeration of microbial population from soil - Bacteria, Fungi, Actinomycetes
2. Isolation of free living nitrogen fixing bacteria from soil – Azotobacter
3. Isolation of symbiotic Nitrogen fixing bacteria from root nodules – Rhizobium
4. Enumeration of microorganisms from phyllosphere
5. Examination of plant diseases
Bacterial Disease - Blight of rice, Citrus canker,
Fungal Disease - Tikka leaf spot of ground nut, Brown rot of potato
6. Bacterial examination of water (qualitative)
7. Standard plate count (quantitative test)
8. Enumeration of microorganism from air
 - Settle plate technique
 - Air sampling techniques
9. Estimation of dissolved oxygen
10. Estimation of BOD and COD
11. Microbiological analysis of food products.
 - Direct microscopic count of organisms in milk (Breed’s count).
 - Detection of Bacteria in milk by standard plate count method (SPC).
12. Quality control testing in milk.
 - Methylene blue test
 - Resazurin test
13. Isolation of *Lactobacilli* and *Streptococci* from curd.
14. Microscopic examination of Microorganisms causing food spoilage

References:

1. Dubey R.C and Maheshwari D.K (2002). **Practical Microbiology**. 1st edition. S. Chand Co. Ltd., New Delhi.
2. Aneja K.R (2003). **Experiments in Microbiology, Plant Pathology and Biotechnology**. 4st edition. New Age International, New Delhi.
3. Cappuccino J and N. Sherman N (2002). **Microbiology: A Laboratory Manual**. 6th edition. Pearson Education Publication, New Delhi.