

PERIYAR UNIVERSITY

PERIYAR PALKALAI NAGAR
SALEM - 636011



DEGREE OF BACHELOR OF SCIENCE

Syllabus for

B.SC. MICROBIOLOGY

CHOICE BASED CREDIT SYSTEM

(SEMESTER PATTERN)

(For Candidates admitted in the Colleges affiliated to Periyar
University from 2021 – 2022 onwards)

REGULATIONS

Program specific outcome (PSO) - microbiology

Bachelor of Science in microbiology students will gain fundamental knowledge about

- The microbiological equipment especially Microscope, Incubator, Laminar Air Flow chamber, Centrifuge etc.,
- The microorganism especially Bacteria, Fungi, Algae, Protozoa, Virus.
- The various fields in microbiology particularly Agricultural, Medical, Environmental, Industrial areas.

Condition for admission (OBE pattern)

A candidate who has passed higher secondary examination in any one of the biological sciences (Botany, Zoology, Biology). (Academic/Vocational stream - Agri, Home Science, Poultry) under higher secondary board of examination, Tamil Nadu or as per norms set by the Government of Tamil Nadu or an examination accepted as Equivalent thereto by the Syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the BSc., Microbiology degree examination of this University after a course of study of three academic years.

Duration of the course

The course for the degree of Bachelor of Microbiology shall consist of three academic years divided into six semesters.

Course of study

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.

Examinations

The theory examination shall be three hours duration to each paper at the end of each semester. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations. The practical examinations for UG course should be conducted in the even semesters.

Maximum Duration for the completion

The maximum duration for completion of the UG Program shall not exceed twelve semesters.

Commencement of this Regulation

These regulations shall take effect from the academic year 2021-22, i.e., for students who are to be admitted to the first year of the course during the academic year 2021-22 and thereafter

COURSE OF STUDY AND SCHEME OF EXAMINATION

SEMESTER – I									
Part	PaperCode	Course	Title	Inst. Hrs/ week	Credit	Exam Hours	Marks		Total
							Int	Ext	
I	21UFTA01	Language-I(LC)	Tamil-I /Malayalam /Hindi-I	6	3	3	25	75	100
II	21UFEN01	Language-II (ELC)	English-I	6	3	3	25	75	100
III	21UMB01	Core -I (CC)	Basics of Microbiology	6	4	3	25	75	100
	21UMBP01	Core Practical-I (CP)	Basics of Microbiology	3	-	-	-	-	-
	21UBCA01	Allied- I(AC)	Biochemistry -I	4	4	3	25	75	100
	21UBCAP01	Allied Practical-I (AP)	Biochemistry Practical	3	-	-	-	-	-
IV		Add-onCourse	rofessionalEnglish	6	4	3	25	75	100
	21UVE01	Value Education	Manavalakkalai yoga	2	2	3	25	75	100
Total				36	20				600
SEMESTER – II									
Part	PaperCode	Course	Title	Inst. Hrs/ Week	Credit	Exam Hours	Marks		Total
							Int	Ext	
I	21UFTA02	Language-I (LC)	Tamil-II/ Malayalam-II/Hindi-II	6	3	3	25	75	100
II	21UFEN02	Language-II(ELC)	English-II	4	3	3	25	75	100
	NMSDC	Language Proficiency for Employability	EffectiveEnglish	2	2	3	25	75	100
	21UMB02	Core - II(CC)	Microbial Physiology	6	4	3	25	75	100

III	21UMBP02	Core Practical-II (CP)	Microbial Physiology	3	4	6	40	60	100
	21UMBP01	Core Practical-I(CP)	Basics of Microbiology	-	4	6	40	60	100
	21UBCA02	Allied -II(AC)	Biochemistry -II	4	4	3	25	75	100
	21UBCAP01	Allied Practical-I (AP)	Biochemistry Practical	3	4	3	40	60	100
IV		Add-on Course	Professional English	6	4	3	25	75	100
	21UES01	Environmental Studies	Environmental Studies	2	-	3	25	75	100
Total				36	32				1000

SEMESTER – III

Part	Paper Code	Course	Title	Inst. Hrs/ Week	Credit	Exam Hours	Marks		Total
							Int	Ext	
I	21UFTA03	Language-I(LC)	Tamil-III/ Malayalam-III/Hindi-III	6	3	3	25	75	100
II	21UFEN03	Language -II(ELC)	English-III	6	3	3	25	75	100
III	21UMB03	Core -III(CC)	Microbial Genetics and Molecular biology	4	4	3	25	75	100
	21UMBP03	Core Practical-III(CP)	Microbial Genetics and Molecular Biology	3	-	-	-	-	-
		Allied -III(AC)	Computer Science - I (Optional)	4	4	3	25	75	100
		Allied Practical - II	Computer Science Practical (Optional)	3	-	-	-	-	-

IV	21UMBS01	SBEC - I	Applied bio techniques	2	3	3	25	75	100
		NMSDC	Digital Skills for Employability- Microsoft Office Essentials	2	2	3	25	75	100
Total				30	19				600

SEMESTER – IV

Part	Paper Code	Course	Title	Inst. Hrs/ Week	Credit	Exam Hours	Marks		Total
							Int	Ext	
I	21UFTA04	Language-I(LC)	Tamil-IV/ Malayalam-IV/Hindi-IV	6	3	3	25	75	100
II	21UFEN04	Language-II(ELC)	English-IV	6	3	3	25	75	100
III	21UMB04	Core –IV(CC)	Immunology and Immunotechnology	4	4	3	25	75	100
	21UMBP04	Core Practical-IV(CP)	Immunology and Immunotechnology	3	4	6	40	60	100
	21UMBP03	Core Practical - III(CP)	Microbial Genetics and Molecular Biology	-	4	6	40	60	100
		Allied - IV(AC)	Computer Science -II (Optional)	4	4	3	25	75	100
		Allied Practical- II(AP)	Computer Science Practical	3	4	3	40	60	100
IV	SBEC-NMSDC	Digital Skills For Employability	Office Fundamentals	2	2	3	25	75	100
		NMEC – II	Choose from Other Department	2	2	3	25	75	100
Total				30	30				900

SEMESTER – V

Part	Paper Code	Course	Title	Inst. Hrs/ Week	Credit	Exam Hours	Marks		Total
							Int	Ext	

III	21UMB05	Core- V(CC)	Medical Bacteriology	5	3	3	25	75	100
	21UMB06	Core- VI(CC)	Food Microbiology	5	4	3	25	75	100
	21UMB07	Core- VII (CC)	Medical Virology	5	4	3	25	75	100
	21UMBP05	Core Practical– V(CP)	Medical and Food Microbiology	5	-	-	-	-	-
	21UMBE01	Elective - I	Medical Parasitology	5	4	3	25	75	100
IV	21UMBS03	SBEC - II	Microbial Biotechnology	3	2	3	25	75	100
IV		NMSDC	Advanced Technology for Employability in Life Science-PCR Technology	2	2	-	-	-	-
	Total			30	19				500

SEMESTER – VI

Part	PaperCode	Course	Title	Inst. Hrs/ Week	Credit	Exam Hours	Marks		Total
							Int	Ext	
III	21UMB08	Core -VIII (CC)	Soil & Agricultural Microbiology	5	4	3	25	75	100
	21UMB09	Core - IX(CC)	Environmental Microbiology	5	4	3	25	75	100
	21UMB10	Core - X (CC)	Industrial Microbiology	5	4	3	25	75	100
	21UMBP06	Core Practical– VI (CP)	Agricultural, Environmental and Industrial Microbiology	5	4	6	40	60	100
	21UMBP05	Core Practical– V (CP)	Medical and Food Microbiology	-	4	6	40	60	100
	21UMBE02	Elective - II	Medical Mycology	5	4	3	25	75	100
			SBEC - III	Entrepreneurial Microbiology	3	3	3	25	75

IV		NMSDC Add on course	Employability Readiness	2	-	-	-	-	-
V	21UEX01	Extension Activities		2	2	-	-	-	
	Total Grand Total			32 194	29 149				700 4300

B.Sc., Microbiology
(CBCS Pattern)
THEORY QUESTION PAPER PATTERN

Time: 3hour

Max. Marks: 75

Part- A (15 Marks) (Answer all the Question)

15x 1 = 15 (Choose the best answer) (3 Questions each unit)

Part- B (5 Marks) (Answer any two questions)

2 x 5 = 10 (One question in each unit)

Part – C (50 Marks)(Either or Choice)

5 x 10 = 50 (Two question from each unit)

B.Sc., Microbiology
(CBCS Pattern)
CORE PRACTICAL QUESTION PAPER PATTERN

Time : 6 hours

Maximum Marks (University Exam)	-	60
Major Practical - 1	-	20 Marks
Minor Practical - 1 & 2	-	2 X 10 = 20 (A &B)
Spotters	-	5 X 2 =10
Record	-	05
Viva voce	-	05
Internal Marks	-	40
Total	-	100

LIST OF COURSES

1. Basics of Microbiology
2. Microbial Physiology
3. Microbial Genetics and Molecular Biology
4. Immunology and Immunotechnology
5. Medical Bacteriology
6. Food Microbiology
7. Medical Virology
8. Soil and Agricultural Microbiology
9. Environmental Microbiology
10. Industrial Microbiology
11. Core Practical-1
12. Core Practical-2
13. Core Practical-3
14. Core Practical-4
15. Core Practical-5
16. Core Practical-6

ELECTIVE COURSES

1. Elective -1-Medical Parasitology
2. Elective-2 –Medical Mycology

SKILL BASED ELECTIVE COURSES (SBEC)

1. SBEC-1- Applied Biotechniques
2. SBEC-2- Microbial Biotechnology
3. SBEC-3-Entrepreneurial Microbiology

ALLIED COURSES

1. Biochemistry -I
2. Biochemistry -II
3. Computer science - I - optional
4. Computer science - II - optional
5. Allied practical - I - Biochemistry
6. Allied practical - II - Computer science

NON MAJOR ELECTIVE COURSES (NMEC)

1. NMEC - 1 - Bio-Fertilizer Technology
2. NMEC - 2 – Mushroom Technology
3. NMEC - 3 - Clinical Lab Technology
4. NMEC - 4- Quality Control in Industry

PART-IV

1. Environmental Studies
2. Value Education-Yoga

PART-V

1. Extension Activities(Awareness program conducted based on hygiene practices to the other department students /nearby school students /village people)

B.Sc., MICROBIOLOGY
SEMESTER I
CORE - I - BASICS OF MICROBIOLOGY

Course Objectives

This subject aims to introduce the history and development of Microbiology. The contents of this course will help students to understand the history, biology, growth and control of microorganisms. Thus the beginners are rightly exposed to understand about Microbiology which would lead them towards progressive advancement of the subject.

Unit- I

Definition and scope of Microbiology – History and recent developments Spontaneous generation – Biogenesis Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchnikoff and Fleming.

Unit- II

Microscopy – Simple and compound Microscopy – Dark field – Phase contrast – Fluorescence and Electron Microscopy.

Unit- III

Microbial Evolution and Diversity - Endosymbiotic theory. Binomial nomenclature of Microbes. Classification - Five kingdoms concept - Eight kingdoms concept (Cavalier Smith).

Unit- IV

Anatomy of prokaryotes - cell wall, cytoplasmic membrane, cilia, flagella capsule, cytoplasmic inclusions, sporulation. Stain and Staining techniques – Simple, differential and special staining.

Unit - V

Sterilization - methods of sterilization and Disinfection. Antimicrobial chemotherapy - tests for sensitivity to antimicrobial agents.

Course Outcome

- ❖ Students will get overall understanding about the fundamentals of microbiology.
- ❖ To understand the concepts of microscopy.
- ❖ Gain knowledge about the microbial evolution and diversity.
- ❖ Acquire information on anatomy of prokaryotes.

REFERENCES

1. Dubey RC and Maheswari DK (2005). A Text book of Microbiology. S.Chand&Company Ltd., NewDelhi.
2. SundaraRajan S (2003). College Microbiology. Volume 1 & 2. Revised Edition, Vardhana Publications, Bangalore.
3. Prescott LM, JP Harley and DA Klein (1993). Microbiology, 2nd Edition, WM, C BrownPublishers.
4. Joanne Willey and Kathleen Sandman and Dorothy Wood, 2020, Prescott's Microbiology, ISBN10: 1260211886 Willey
5. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). "Microbiology"- 5th Edition McGraw Hill Inc. New York.
6. <https://www.elsevier.com/books/encyclopedia-of-microbiology/schmidt/978-0-12-811736-1>
7. https://www.researchgate.net/publication/324037626_Basic_Medical_Microbiology

B.Sc., MICROBIOLOGY
SEMESTER II
CORE - II - MICROBIAL PHYSIOLOGY

Course Objectives

To understand the kinetics of microbial growth and influence of varied physio chemical parameters. The information on energy deriving process of a living cell from organic and inorganic substances explained through metabolic reactions. To endow with the process of synthesizing macromolecules and their role in metabolism.

Unit - I

Nutritional requirements of Microorganisms- Autotrophs, Heterotrophs, Chemotrophs, Copiotrophs and Oligotrophs. Transport Mechanisms - Diffusion- Facilitated Diffusion, Active transport- Group translocation.

Unit- II

Different phases of growth - Growth curve - Generation time - Factors influencing microbial growth - Temperature, pH, hydrostatic pressure and radiation synchronous growth and continuous cultivation. Diauxic growth, Sporulation – Endospore formation in bacteria.

Unit- III

Metabolism - EMP, HMP, EDPathway - TCA cycle - Electron transport chain, Phosphorylation, Oxidative Phosphorylation, Substrate level Phosphorylation

Unit- IV

Anaerobic respiration - sulphur, nitrogenous compounds and CO₂ as a final electron acceptor- Fermentation: Alcoholic fermentation, mixed acid fermentation, lactic acid fermentation

Unit- V

Photosynthesis - Characteristics and types of Photosynthetic Prokaryotes. CO₂ fixation
Oxygenic and Anoxygenic - Bio luminescence.

Course Outcome

- ❖ The students will get an overall understanding of basic cell structure and classification of microorganisms based on its nutritional requirements.
- ❖ Gain knowledge on the growth pattern of microorganisms and the influence of nutrients to obtain active growth phase.

- ❖ Information on energy deriving mechanism from different energy sources.
- ❖ Acquire information on synthesis of organic molecules via photosynthetic process

REFERENCES

1. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill.
2. Dubey RC and Maheswari DK (2012). A Text of Microbiology. Revised edition, S. Chand and Company Ltd., New Delhi.
3. Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Tata McGraw-Hill INC., New York.
4. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology. Fourth edition, A John Wiley sons, Inc. publication. New Delhi.
5. Lehninger, Principles of Biochemistry (IE) 7th Edition (2017) by David L. Nelson
6. <https://www.elsevier.com/books/bacterial-physiology-and-metabolism/sokatch/978-1-4832-3137-2>
7. <https://www.frontiersin.org/journals/microbiology/sections/microbial-physiology-and-metabolism>

B.Sc., MICROBIOLOGY
SEMESTER III
CORE - III - MICROBIAL GENETICS AND MOLECULAR BIOLOGY

Course objectives

To make the students to understand the genetics and molecular biology of microbes. To gather the sound knowledge about gene expressions of target genes. To bring advancement in human life.

Unit - I

Historical introduction - DNA and RNA as the genetic material - DNA double helix - plasmid structure and its types. Bacterial chromosome organization, structure and function of DNA, RNA and its types.

Unit - II

DNA Replication in prokaryotes - enzymology of replication – DNA polymerase III structure - Rolling circle replication. Replication of RNA – reverse transcriptase.

Unit -III

Mutation - types of mutation - spontaneous and induced mutation - mutagens. Detection of mutants- Ames test. DNA repair mechanisms.

Unit - IV

Transcription – Enzymatic synthesis of RNA, Classes of RNA molecules, Translation - Genetic code – Regulation of gene expression in prokaryotes – Operon concept – lac and trp operons.

Unit - V

Gene transfer mechanisms - Transformation, Conjugation and Transduction (Specialized and Generalized). Transposons.

Course outcome

- ❖ Understand the knowledge about the genetic material and DNA replication.
- ❖ Created an understanding about mutation and its types.
- ❖ Procured the knowledge about Transcription and Translation.
- ❖ Learned about gene transfer mechanisms in bacteria.

REFERENCES

1. Klug. W.S. and Cummings. M.R., (1996), Essentials of Genetics. Mentics Hail. Newjersey.
2. Gardner. E.J. Simmons, M.J. and D.P. Snusted, (1991), Principles of Genetics, S'h edition. John Wiley and Sons, NY.
3. Peter J Russell PJ. Genetics- A Molecular Approach. 3rd edition, Benjamin Cummings. 2009.
4. David Friefelder (1995). Molecular biology.Narosa publishing house, New Delhi.
5. Daniel L Hartl and Elizabeth W Jones. Genetics-Analysis of Genes and Genomes, Jones and Bartlett publishers, UK, 2001.
6. <https://openstax.org/books/concepts-biology/pages/9-2-dna-replication>
7. [https://en.wikipedia.org/wiki/Transcription_\(biology\)](https://en.wikipedia.org/wiki/Transcription_(biology))

B.Sc., MICROBIOLOGY
SEMESTER III
SBEC - I - APPLIED BIOTECHNIQUES

Course objectives:

To introduce the structure and function of macromolecules in living organisms. It reveals the basic concepts of instrumentation used in biotechniques. It imparts the knowledge on identification of physical properties of biochemical composition to provide better chemical information. To improve the efficacy of qualitative and quantitative analysis of different molecules involved in biochemical reactions.

Unit - I

Colorimetry - Principles, Instrumentation and Applications – Spectrophotometry: -UV – VIS and IR, Fluorometry, Flame photometry, NMR, ESR - Principles, Instrumentation and Applications. Analysis – Qualitative and Quantitative. pH meter and the types of electrodes

Unit - II

Centrifugation: Principle and applications - types of centrifuges.- low speed, high speed, ultra centrifuge, Differential centrifugation - density gradient centrifugation.

Unit -III

Chromatography: Principles, Instrumentation, Types and Detection methods – Paper, TLC, HPLC, GC, Ion-exchange, Column, Gel permeation and applications. Electrophoresis – .Principles, Instrumentation and types. Staining and Detection methods – Isoelectrophoresis – isoelectric focusing – Western blotting -Applications.

Course outcome

- ❖ To acquire the basic science behind the research techniques.
- ❖ Students will become familiar with biotechniques like chromatography, electrophoresis and spectrophotometry for quantitative and qualitative analysis
- ❖ Students will be inculcated with precise and accurate interpretation skills in the research sector.
- ❖ To imbibe the knowledge on modernised analytical methods to step in hi-tech industries.

REFERENCES

1. Physical Biochemistry: David Freifelder. .
2. Practical Biochemistry, Keith Wilson and John Walker, 4 ed 1994.
3. BajpaiPK (2010). Biological Instrumentation and Methodology. Revised edition, S.Chand&Co.Ltd., New Delhi.
4. Subramanian MA (2005). Biophysics - Principles and Techniques. First edition, **MJP** Publishers, AUnit of Tamil Nadu Book House, Chennai.
5. John G Webster (2004). Bioinstrumentation. Student edition. John Wiley and Sons, Ltd.
6. <https://chromatography.conferenceseries.com/events-list/applications-of-chromatography>
7. <http://www.biologydiscussion.com/biochemistry/centrifugation/centrifuge-introduction-types-uses-and-other-details-with-diagram/12489>

B.Sc., MICROBIOLOGY
SEMESTER V
CORE - IV - IMMUNOLOGY AND IMMUNOTECHNOLOGY

Course objectives

Impart knowledge on immune cells and organs and elementary principles of antigen antibody interactions. Understanding the transplantation immunology, hypersensitivity reactions, autoimmunity, vaccines and its response to immune system.

Unit - I

History of Immunology, Innate immunity and acquired immunity, Haematopoiesis, Cells and organs of immune system. B -cell and T- cell activation. Phagocytosis.

Unit- II

Antigen – Antigenicity, Immunogenicity, Properties of antigen, immunogen, Adjuvant, Hapten. Antibody- structure and types. Antigen - Antibody interactions, Complement system - classical and alternative pathways.

Unit- III

Hypersensitivity reactions - types, Antibody mediated (Type- I, Type II, Type III) and Cell mediated (Type- IV). Auto immune diseases - Types and mechanisms.

Unit-IV

Immuno - hematology, Blood group, Rh - incompatibilities. Transplantation Immunology - HLA Tissue Typing - Mechanism of acceptance and rejection. Vaccines – Types and Immunization schedule.

Unit- V

Immunotechniques - Antigen - Antibody interaction -Agglutination - Precipitation - Flocculation - ODD - RIA- IFT- CFT- ELISA - Immuno electrophoresis. Monoclonal antibodies (Hybridoma technology).

Course outcome

- ❖ The students will get overall understanding of history and evolution of immunology and immune response developed by human system
- ❖ To understand the concepts of antigen, antibody interactions and influence on human immune system via hypersensitivity reactions, autoimmune diseases etc.

- ❖ Detailed understanding of Immunohaematology, Transplantation Immunology and Vaccines which will make the minds aware of infection, prevention and control.
- ❖ Help the students to learn techniques involved in immunological concepts and its role in diagnostic immunology

REFERENCES

1. Kuby Immunology - Richard A Goldsby, Thomas J Kindt. Barbara A Osborne, (2000). Fourth edition, W H Freeman and company. New York.
2. Ananthanarayan & Paniker's. (2013). Text Book of Microbiology, 9th Edition, Universities Press.
3. Tizard K (1983). Immunology. An Introduction. Saunders college publishing, Philadelphia.
4. Roitt, IM (1988). Essentials of Immunology. ELBS-Blackwell Scientific Publishers, London.
5. Chakravarthy A R (2006) Immunology and Immunotechnology, First Edition, Oxford University Press, India. ISBN: 9780195676884
6. <https://www.ncbi.nlm.nih.gov/books/NBK10779/>
7. http://www.imgt.org/IMGTeducation/Tutorials/ImmuneSystem/UK/the_immune_system.pdf

B.Sc., MICROBIOLOGY
SEMESTER V
CORE - V - MEDICAL BACTERIOLOGY

Course objectives

Designed to develop a basic understanding about infection and the causative bacteria, their differentiation and to gain knowledge on various diseases generated during the pathogenic role of those organisms, this course also deals with the diagnostics and treatment

Unit - I

Infections - sources of infections, Types of infections - methods of infections - Definitions - epidemic, pandemic, endemic, Acute, Chronic, systemic and opportunistic diseases. Virulence factors of bacteria causing human infections -carriers and types. Normal flora of human.

Unit- II

Morphology, Pathogenicity, Biochemical laboratory diagnosis and prevention of bacterial diseases- *Staphylococcus aureus*, *Streptococcus pyogens*, *S. pneumoniae*, *Neisseria sps.*

Unit- III

Morphology, pathogenicity, biochemical laboratory diagnosis and prevention of bacterial diseases – *Bacillus anthracis*, *C.diphtheriae*, *Clostridium tetani*, *Mycobacterium tuberculosis*, *M.leprae*.

Unit-IV

Morphology, pathogenicity, biochemical laboratory diagnosis and prevention of bacterial diseases - *Salmonella typhi*, *Shigelladysentriae*, *Vibrio cholerae*, *E.coli*, *Proteus vulgaris*, *Klebsiellapneumoniae*, *Pseudomonasaeruoginosa*, *Yersinia pestis*.

Unit- V

Morphology, pathogenicity, biochemical laboratory diagnosis and prevention of bacterial diseases - *Treponemapallidum*, *Leptospirainterrogans*, *Mycoplasma pneumoniae*, *Haemophilusinfluenzae*.

Course outcome

- ❖ Understood the basic and general concepts of infections and the various parameters of causing infections. Assessment of their severity including the broad categorization of the

methods of diagnosis.

- ❖ Developed a thorough understanding of common Gram positive bacterial diseases of human being.
- ❖ Conceptualized the role of the some bacteria as well as the mechanisms underlying the pathogenicity of them.
- ❖ Developed a thorough understanding of some special pathogenic bacteria affecting the human organ systems

REFERENCES

1. Ananthanarayan R. and Paniker C.K.J. (2017) Textbook of Microbiology. 10th edition, Kanungo, Reba (Ed).Orient Blackswan Publication.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2016) Jawetz, Melnick and Adelberg's Medical Microbiology. 27th edition. McGraw HillPublication.
3. Willey JM, Sherwood LM, and Woolverton CJ. (2017) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
4. Madigan , Bender, Buckley, Sattley and Stahl. (2018). Brock Biology of Microorganisms. 15th edition. Pearson Global Edition.
5. Tortora GJ, Funke BR, and Case CL. (2016). Microbiology: An Introduction. 11thedition Pearson Education India.
6. <https://mechpath.com/2015/12/01/mycobacterium-leprae/>
7. https://www.slideshare.net/El_Omda/anthrax-15737452

B.Sc., MICROBIOLOGY
SEMESTER V
CORE – VI - FOOD MICROBIOLOGY

Course Objectives

To educate students about the food micro flora, role of microbes in food fermentation, food preservation, food spoilage and food safety regulations.

Unit - I

Food and microorganisms -Important microorganisms in food (bacteria, molds and yeasts).Sources of contamination of food.Factors that influence microbial growth in food - Intrinsic factors -extrinsic factors.Microbes as food - single cell protein (SCP) - probiotic and symbiotic – benefits and applications.

Unit - II

Food sanitation and principles of food preservation - Food sanitation, good manufacturing process - hazard analysis, critical control points and personnel hygiene. General principles methods of food preservation – asepsis, removal of microorganisms, anaerobic conditions, high temperature, low temperature, drying, radiation, smoking, chemical preservatives and food additives.

Unit - III

Spoilage of food and fermented food products - Sources, contamination, spoilage, preservation and control - cereals and cereals products, vegetables and fruits, meat and meat products, sugar and sugar products, egg and poultry, fish and sea foods, canned foods. Fermented food – bread, sauerkraut and soy sauce.

Unit - IV

Production and spoilage of various dairy products - Sources, contamination, spoilage, preservation of milk and milk products – yoghurt, cheese and butter - Quality control of milk – MBRT, litmus milk, alkaline phosphatase test and resazurin test.

Unit - V

Food borne diseases, food standards and quality assurance - Food borne infections – bacterial, algal, protozoan and mycotoxins.Sea food poisoning – investigation of food poisoning and its outbreaks.Food standards and quality assurance – HACCP, FDA, WHO, FSSAI, ISI, EPA, BIS, AGMARK, INFOSAN.

Course outcome

- ❖ Know the positive and negative role of microbes in food.
- ❖ Gain knowledge about fermented food products.
- ❖ Understand the significance of food borne diseases.
- ❖ Realize the importance of food sanitation and quality assurance.

REFERENCES

1. Frazier WC and Westhoff DC. (2014) Food Microbiology, Fifth edition, Tata McGraw-Hill Publishing Ltd., New Delhi.
2. Adams MR and Moss MO (2008) Food Microbiology, fourth edition, published by the royal society of chemistry, Cambridge,.
3. Hobbs BC, Roberts D (1993). Food Poisoning and Food Hygiene Edward Arnold, London.
4. Kulshreshtha SK. 1994, Food Preservation, Vikas Publishing House Pvt. Ltd.,New Delhi.
5. KhetarpaulNeelam. Food Processing and Preservation, Daya Publishing House, Delhi. 2005.
6. <https://www.fda.gov/>
7. https://en.wikipedia.org/wiki/Food_Safety_and_Standards_Authority_of_India

B.Sc., MICROBIOLOGY
SEMESTER V
CORE - VII - MEDICAL VIROLOGY

Course objectives

It covers the knowledge on history, general characters, and the classification of the viruses and also it is designed to comprehend the mechanisms of different viral infections affecting human, knowledge on the diagnostic methods and their prophylactic measures. This course also describes about the current viral epidemics threatening the whole world.

Unit- I

General properties - Structural- Classification- Cultivation - Isolation and identification of viruses - Serodiagnosis and molecular diagnosis of viral infections. Antiviral Agents.

Unit- II

Pox viruses - Variola, Herpes viruses - Herpes Simplex Virus, Cytomegalo Virus, Epstein Barr Virus.

Unit- III

Adena viruses, Hepatitis viruses, Papova viruses, Papilloma, Polyoma, Parvo virus, Retro virus - HIV.

Unit- IV

Picorna viruses - Polio, Rhino virus, Orthomyxovirus - Influenza, Paramyxo virus - Parainfluenza, Mumps, Measles, Rhabdo virus, Rota virus.

Unit- V

Arbo viruses: Flavi viruses- Yellow fever viruses- Dengue virus- Chickungunya virus - Japanese encephalitis virus. Emerging viral epidemics – Influenza H1N1, Nipah, corona - covid 19, Zika and Ebola Viruses. Vaccines for viral diseases.

Course outcome

- ❖ Understood and Recognize characters of different types of viruses causing infections, assessment of their severity, methods of diagnosis and their prophylaxis.
- ❖ Recognize how the two different classes, DNA and RNA viruses causing viral diseases in human beings.
- ❖ Conceptualized the role of viruses as well as the mechanisms underlying the pathogenicity of them, their detection and prophylaxis.

- ❖ Developed a thorough understanding of some special pathogenic viruses causing recent epidemics and threatening the whole world.

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B.Sc., MICROBIOLOGY

SEMESTER V

ELECTIVE - MEDICAL PARASITOLOGY

Course objectives

The candidate will gain knowledge about the morphology of protozoans and helminthes, life cycle patterns, pathogenesis, clinical findings, transmission of parasites, identification and treatment.

Unit - I

Introduction to Parasitology, Classification, Host-Parasite relationship. Lab diagnosis of parasitic infections. Examination of faeces – Direct and concentration methods, examination of blood – Thin and Thick smear method.

Unit - II

Morphology, Transmission, Lifecycle, Pathogenesis, Clinical manifestations, Culture, Lab Diagnosis and treatment of Protozoans – *Entamoeba histolytica*, *Giardia intestinalis*, *Trichomonas vaginalis*, *Balantidium coli*

Unit - III

Leishmaniadonovani, Trypanosomes – *Trypanosomacruzi*, Sporozoites – Malarial parasites (*Plasmodium falciparum*, *P.vivax*, *P.ovale*)

Unit - IV

Cestodes – *Taeniasolium*, *Taeniasaginata*, Trematodes– *Fasciola hepatica*, *Paragonimus westermani*, Nematodes–*Ascaris limbricoides*, *Ancylostoma duodenale*, *Enterobius vermicularis*, Filarial worm – *Wuchereria bancrofti*.

Unit – V

Medical Entomology – Vectors - Classification, morphology and metamorphosis of insects–Mosquitoes, Sand fly, Ticks, Fleas, Housefly and Mites. Vector borne diseases and its control measures.

Course outcome

- ❖ Understanding of taxonomy of parasite and host – parasite interaction.
- ❖ In depth knowledge on clinical diagnosis, pathogenicity and life cycle of protozoans
- ❖ Assimilate various lab technologies for diagnosis of medically important protozoans and their treatment.

- ❖ Articulate the major means of transmission of parasites by insect vectors and their control measures.

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1. Subhas Chandra Parija (2004). Text book of Medical Parasitology. Second edition, All India Publishers and Distributors, Medical Books Publishers, New Delhi.
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B.Sc., MICROBIOLOGY
SEMESTER V
SBEC - II – MICROBIAL BIOTECHNOLOGY

Course objectives

To understand the Microbial biotechnology. To gather the sound knowledge about desirable characteristics can be improved in the living bodies by controlling expressions of target genes. This technology has multidisciplinary applications and the potential to deal with important aspects of life.

Unit - I

Introduction, Milestones in rDNA technology, strategies involved in gene cloning. Construction of cDNA library and genomic DNA library.

Unit - II

Restriction enzymes, Nomenclature, Types and its applications. DNA modifying enzymes. DNA ligases. Plasmid vectors -pBR and pUC series, Bacteriophage lambda and M13 based vectors. Phagemid. Cosmids. Shuttle vectors. YACs.

Unit - III

Transformation – electroporation, Biolistic method (gene gun), Microinjection. Screening and selection of recombinants – Colony hybridization. PCR and applications, -DNA Sequencing. Blotting techniques. Transgenic Plants.

Course outcome

- ❖ Understand the knowledge about The Basic Principles of Gene Cloning.
- ❖ Acquire knowledge about Molecular Cloning Tools
- ❖ Created an understanding about Cloning Vectors Gene transfer Techniques
- ❖ Procure the knowledge about Methods in Molecular Cloning

REFERENCES

1. Brown TA. (2010). Gene Cloning and DNA Analysis. 6th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology: Applying the Genetic Revolution. Elsevier Academic Press, USA
3. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.

4. Sambrook J and Russell D. (2001). Molecular Cloning-A Laboratory Manual. 3rd edition. Cold Spring Harbor Laboratory Press
5. David Friefelder (1995). Molecular biology.Narosa publishing house, New Delhi.
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B.Sc., MICROBIOLOGY
SEMESTER VI
CORE – VIII -SOIL AND AGRICULTURAL MICROBIOLOGY

Course objectives

Transforming student society caring nature as an eco-friendly one by introducing the relationship between microbes and nature, its roles and its utilization for the creation of sustainable environment.

Unit - I

Development of Soil Microbiology - Distribution of microorganisms in soil - quantitative and qualitative microflora of different soils - Role of microorganisms in soil fertility –Factors Influencing the soil microflora

Unit - II

Microorganisms in soil processes - carbon cycle - organic matter decomposition - Humus formation - Nitrogen cycle – Mineralization - Ammonification - Nitrification, Denitrification - reactions - organisms involved - Nitrogen fixation – symbiotic and non-symbiotic- process of nitrogen fixation.

Unit - III

Microbial transformation of phosphorus, sulphur and micronutrients in soil - phosphorus solubilization by phosphobacteria - sulphur cycle, sulphur bacteria and their importance. Interrelationships between plants and microorganisms - Rhizosphere - spermosphere - phyllosphere.

Unit - IV

Mycorrhiza - ecto and endomycorrhiza – distribution and importance – Plant growth regulators and phytotoxin production by microorganisms - use of soil microorganisms for pest and disease control - Pesticide and soil microflora - interactions.

Unit -V

Symptoms, characters of pathogens and control measures. Bacterial diseases – Citrus canker, Blight of rice. Fungal diseases – Red rot of sugarcane, Tikka leaf spot of ground nut. Viral diseases – TMV, Vein clearing disease of Bhendi (*Abelmoschus esculentus*).

Course outcome

- ❖ Able to understand the distribution of microbes in soil
- ❖ Capable to get information about biogeochemical cycle
- ❖ Able to get the knowledge about microbial interaction
- ❖ Capable to get idea about plant disease

REFERENCES

1. Alexande, M 1976, Introduction to soil microbiology Willy Eastern Ltd. New Delhi.
2. Coyne, M.S. 2000. Soil Microbiology, CBS Publications, New Delhi.
3. Rangaswamy G and Bagyaraj. 2001. Agricultural Microbiology, Prentice Hall of India Pvt. Ltd, New Delhi.
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B.Sc., MICROBIOLOGY
SEMESTER VI
CORE - IX - ENVIRONMENTAL MICROBIOLOGY

Course objectives

To provide a Fundamental and applied knowledge about the various scopes in Environmental microbiology. To study the distribution and role of microorganisms in Biosphere for improvement of environmental quality, the discovery of microorganisms with metabolic potentials that can be employed Pollution control.

Unit - I

Concept and scope of environmental microbiology: Biodiversity, Distribution of microorganisms in nature, adaptations of microbes, Environmental problems and microbial solutions. Microorganisms inhabiting extreme environments. Environmental education. Environmental organizations and conventions.

Unit - II

Biosphere- three major ecosystems. Lithosphere – Composition- soil microbes, factors influencing their distribution, Energy flow, food chain and food web. Hydrosphere- watermicrobes, bioluminescence, energy flow, pyramid of biomass. Atmosphere- regions of atmosphere – Aeromicroflora of hospitals and other houses. Air sampling and disease forecasting.

Unit - III

Microbial interactions – Plant- microbe interactions and Microbe-microbe interactions- Beneficial- commensalism, synergism, symbiosis. Harmful- competition, amensalism, predation and parasitism. Solid waste management, Vermicomposting, Biogas technology, anaerobic digestion by methanogens.

Unit - IV

Pollution- classification of pollution, pollutants -Soil pollution- plastic, fertilizer, pesticide pollution. Water pollution- sources and nature of pollutants in water, BOD, COD, Eutrophication. Water borne diseases, Purification of waste water- Air Pollution – Acid rain – impact on ecosystem – gaseous emission – Green house effect – Global warming, Ozone layer depletion.

Unit -V

Bioremediation concepts - Mineral leaching by bacteria –Biomining of metals – Heavy metal pollutants removed by bioaccumulation. Microbial extraction of oil, Biodegradation of petroleum, Microbial degradation of xenobiotics –Microorganisms in abatement of heavy metal pollution – Heavy metal tolerance in microbes – Microbial plastics

Course outcome

- ❖ Able to understand about the microbial diversity in environmental
- ❖ Capable to get information about the ecosystem
- ❖ Able to get overall understand the pollution
- ❖ Capable to understand basic knowledge about bioremediation

REFERENCES

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B.Sc., MICROBIOLOGY
SEMESTER VI
CORE – X - INDUSTRIAL MICROBIOLOGY

Course objectives

To introduce the role of microbes in industries. To impart knowledge on different types of fermentors and fermentation processes. To familiarize with the various industrial production process involving microbes. To provide the information on the role of various factors influencing the fermentation processes.

Unit - I

Industrially important microorganisms - Screening Techniques- Primary and Secondary - Preservation of cultures - Strain improvement- Development of inoculum for various fermentation processes.

Unit - II

Fermentor - Components, Types of fermentors, Control systems in fermentation - pH, Temperature, Oxygen and foam. Computer applications in fermentation technology

Unit - III

Media for industrial fermentation - submerged and solid state fermentation- Downstream processing-Recovery and purification of intra cellular and extracellular products.

Unit - IV

Microbial production Alcoholic beverages - Wine, beer, ethanol. Organic acids - Citric acid and Acetic acid.

UNIT V

Microbial production of Amino acid- Lysine. Enzyme- Alpha amylase and protease. Vitamin B12- Antibiotics- Penicillin, Streptomycin.

Course outcome

- ❖ Able to select and design a fermentation process for a specific product
- ❖ Capable of identifying industrially important microbes and its potential applications
- ❖ Able to devise means to improve the production rate of existing fermentation processes
- ❖ Capable of designing processes for higher production yield at economically cheaper rate

REFERENCES

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4. Manual of Industrial Microbiology and Biotechnology, III edition, Arnold L. Demain and Julian Davies, ASM press, Washington DC, 1999.
5. Handbook of Downstream processing, Edin Goldberg, Blackie and Academic Professional, 1997.
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B.Sc., MICROBIOLOGY
SEMESTER VI
ELECTIVE - II - MEDICAL MYCOLOGY

Course objectives

To acquire basic knowledge of general properties and taxonomy of medically important fungi, morphological features, diseases caused by fungi, pathogenesis, diagnosis and treatment of fungal infections.

Unit - I

Introduction to Medical Mycology. Morphological features and methods of reproduction of fungi. Classification of medically important fungi. Culture media and stains in Mycology. Collection, transportation, isolation, identification and identification of mycological agent from clinical specimens.

Unit - II

Superficial mycosis - Pityriasis versicolor, Tinea nigra, Black and White Piedra. Otomycosis - Cutaneous mycosis - Dermatophytosis.

Unit - III

Subcutaneous mycosis - Sporotrichosis, Mycetoma, Chromoblastomycosis. Systemic mycosis - Histoplasmosis, Coccidioidomycosis, Blastomycosis

Unit - IV

Opportunistic mycosis - Candidiasis, Cryptococcosis, Aspergillosis, Penicilliosis.

Unit - V

Allergic fungal diseases - Bronchial Asthma, Maple Bark Stripper's disease - Antifungal agents - type and mode of action. Sensitivity tests, Mycotoxins (Mycotoxicosis and Mycetismus).

Course outcome

- ❖ Basic understanding of fungi, their morphology and culture methods of fungi.
- ❖ Obtain knowledge on pathogenicity and laboratory diagnosis of medically important fungi.
- ❖ Grasp knowledge on mycotoxins and their importance.
- ❖ Gain knowledge on antifungal agents and their testing methods.

REFERENCES

1. Rajan S (2009). Medical Microbiology. First edition, MJP Publishers, Chennai.

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3. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries. Part 1 & 2 Low-Price edition, Cambridge University Press.
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6. <https://mycology.adelaide.edu.au/>
7. https://en.wikipedia.org/wiki/Oppportunistic_infection

SEMESTER VI
SBEC III - ENTREPRENEURIAL MICROBIOLOGY

Course objective

The aim of the course is to make the student to learn importance of microorganism in various fields. To understand the patenting process and to know the different financial agencies support for entrepreneurship

Unit- I

Entrepreneur development - activities, Institutes involved, Government contributions to entrepreneur, risk assessment, Industrial Microbiology - Definition, scope and historical development.

Unit - II

Microbial cells as fermentation products Baker's yeast, food and feed yeasts, bacterial insecticides, legume inoculants, SCP production, Enzymes as fermentation products bacterial and fungal amylases, proteolytic enzymes.

Unit - III

Brewing-Media components, preparation of medium, involved, maturation, carbonation, packaging, keeping quality, contamination, byproducts. Production of industrial alcohol. Patent and secret process, History of patenting, composition, subject matter and characteristics of a patent, inventor, infringement, cost of patent. Patent in India and other countries.

Course outcome

- ❖ To make Knowledge about the role of microbes in Industries
- ❖ Gained knowledge about fermented products.
- ❖ To understand the significance of patenting
- ❖ Able to make the students ideally skilled for self-employment

REFERENCES

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2. LECassidaJR(2005).IndustrialMicrobiology.NewAgeInternational(P)Ltd.,NewDelhi.
3. Arora.EntrepreneurialDevelopmentinIndia.
4. Aneja, K.R. Experiments in Microbiology, Plant Pathology, Tissue Culture and MushroomProductionTechnology,6thEdition,NewAgeInternationalPublication.
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7. http://laghu-udyog.gov.in/sido/ppdc_agra.htm

B.Sc., MICROBIOLOGY
NMEC - I – BIOFERTILIZER TECHNOLOGY

Course objectives

The aim of the course is to make the student to learn importance of biofertilizers in agriculture and to know about field application and production technologies.

Unit - I

Definition and types, importance of biofertilizers in agriculture, Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Biofertilizers – carrier materials - storage, shelf life, foliar applications, quality control and marketing.

Unit - II

Isolation, identification, characterization, mass multiplication, formulation, field application and benefits of *Rhizobium*, *Azospirillum*, *Azotobacter* and Cyanobacteria

Unit - III

Phosphate solubilizing bacteria - isolation, identification, characterization, mass cultivation, formulation, field application and benefits. Mycorrhizae – Ecto and Endo (Arbuscular mycorrhizae). Isolation, identification, characterization, mass cultivation, formulation, field application and benefits.

Course outcome

- ❖ Able to get basic idea about biofertilizer production
- ❖ For to learn application techniques about biofertilizer
- ❖ Capable to make mass multiplication
- ❖ Able to make the students ideally skilled for self-employment

REFERENCES

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2. Mahendra K Rai. Hand book microbial biofertilizers. 9th edition. The Haworth press, Inc. New York.2015.
3. Ramesh Chandra and Raverkar KP. Bioresources for sustainable plant nutrient

management, scholars world publishers, New Delhi.2014.

4. Reddy SMLV, Gangwane P, Prakash and Kunwar IK. Bioinoculants for sustainable agriculture and forestry. Scientific publishers, Jodhpur.2002.
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6. <https://www.abebooks.com/Biofertilizer-Technology-Tanuja-Singh-Purohit-Agrobios/1267246944/bd>
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B.Sc., MICROBIOLOGY
NMEC – II – MUSHROOM TECHNOLOGY

Course objective

To make the students to understand about the mushroom cultivation technology, spawn preparation, diseases control and the medicinal values of Mushroom

Unit- I

Introduction-History-Scope and importance of mushroom cultivation. Present status of mushroom industry in India - Mushroom research and development - Pure Culture- Media-Preparation and maintenance of mother culture. Spawn production - types- methods storage and transportation.

Unit- II

Cultivation Technology - Infrastructures- substrates - inoculation methods. Mushroom bed preparation. Preservation technology- long term storage - short term storage.Post-harvest handling. Types and importance of edible mushroom in India-*Agaricusbisporus*, *Pleurotussps*, Mushroom contamination. Poisonous Mushroom.

Unit -III

Nutritional and Medicinal values of Mushroom - protein - carbohydrates - vitamins - minerals – fiber content. Preparation of low calorie foods – soups curry. Marketing values in India- export value.

Course outcome

- ❖ Able to get basic idea about mushroom cultivation
- ❖ For to learn techniques about spawn multiplication
- ❖ Capable to identify the diseases of ediblemushrooms
- ❖ Able to make the students ideally skilled for self employment

REFERENCE

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2. Suman BC andSharmaVP. Mushroom Cultivation, Processing and Uses. Agribios(India) Publishers, Jodhpur.2005.
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Coimbatore.

4. NitaBahl(1988).HandbookofMushroom,2ndEdition,Vol.I&II.
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B.Sc., MICROBIOLOGY
NMEC - III- CLINICAL LABORATORY TECHNOLOGY

Course objectives

The course contents are designed to teach various methods of sterilization, handling various instruments used in the clinical laboratories and its significance in diagnostic field. To train the students on various diagnostic techniques especially to identify the different types bacteria and fungi from the clinical samples.

UNIT - I

Safety measures in a Laboratory. Laboratory instruments - Centrifuge - Ovens - Water Bath - Incubator – Laminar Airflow- Calorimeter-Working and applications.Rules of clinical laboratory - Maintenance of laboratory records - General precautions for avoidance of laboratory accidents. Standard protocol of biomedical waste disposal.

UNIT - II

Methods of clinical specimensCollection - Blood, Urine, Sputum, CSF, Pus and Feces.Staining techniques-Simple and differential- Gram's.Lacto phenol - cotton blue. Biochemical analysis - Urine analysis, physical, chemical, microscopic, routine test viz., sugar, albumin and phosphates, other tests - bile salt, bile pigment, urobilin ketone bodies.

UNIT - III

Introduction to haematology, collection of blood sample and anticoagulants, Specimen collection and processing in hematology, haemocytometer and procedure for RBC, WBC, ESR count, haemoglobin estimation, bleeding time with normal values and interpretation

Course outcome

- ❖ Learn the handling of instruments and various measurements used in the laboratory.
- ❖ Gained knowledge about laboratory techniques its significance in diagnostic evaluation.
- ❖ Identify and differentiate the different types of bacteria and fungi in clinical samples.
- ❖ Learn the differential diagnosis by the help of different serological techniques.

REFERENCES

1. Monica Cheesbrough (2006) *District Laboratory Practice in Tropical Countries Part 1 & 2*, 2nd Edition, Cambridge UniversityPress.

2. Tortora, G.J., Funke, B.R. and Case, C.L. (2016) *Microbiology: An Introduction*, 11th Edition, Pearson Education, India
3. Madigan, T.M., Martinko, M.J., Bender, S.K., Buckley, H.D., Stahl, A.D. and Brock, T. (2017) *Brock Biology of Microorganisms*. 14th Edition, Licensing agency, UK.
4. Baveja, C.P. and Baveja, V. (2017) *APC Text Book of Microbiology*, 4th Edition, Arya Publications, NewDelhi.
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B.Sc., MICROBIOLOGY

NMEC - IV - QUALITY CONTROL IN INDUSTRIES

Course Objective

The objective of this course is to impart basic knowledge about quality control in pharmaceutical industry, quality control audits in industries. Train the students on the basics of food safety and food quality. To teach the microbial quality control in hospitals aim to impart knowledge on manufacturing operation in industries

UNIT - I

Industrial quality control-Process of quality control- sterile and non-sterile preparations – raw materials, purity check, quality check of finished products - Pharmaceutical products and their quality control-drugs and vaccines. Environmental Monitoring – Pharmaceutical industry.

UNIT - II

Food safety and Food Quality-Microbiological criteria of food, food products, Monitoring of factory hygiene and sanitation, Food Safety and Standards. Food contaminants and diseases. Microbial quality control in Hospitals-Control of Healthcare associated infections - Monitoring water quality in hospitals, healthcare infrastructures.

UNIT - III

Manufacturing operations and controls-Sanitation of manufacturing premises, cross contamination, processing of bulk products, packaging operations, release of finished product. Expiry date calculation, calculation of yields, production record review, and handling of waste and scrap disposal.

Course Outcome

- ❖ To acquire the knowledge quality control in pharmaceutical industry
- ❖ To learn the quality control audits in industries.
- ❖ To understand the basics of food safety and food quality.
- ❖ Skilled on manufacturing operation in industries

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B.Sc., MICROBIOLOGY
SEMESTER I
CORE PRACTICAL - I
BASICS OF MICROBIOLOGY

1. Handling of microbiological laboratory instruments and Laboratory safety measures.
2. Handling and Maintenance of compound microscope.
3. Cleaning of glassware and preparation of cleaning solutions
4. Principles and methods of Sterilization: moist heat, dry heat, filtration, and chemical sterilants.
5. Colorimeter- Beer & Lambert's law
6. pH meter- principle and measurements
7. Preparation of media
 - a. Liquid media
 - b. Solid media
 - c. Enriched Medium
 - d. Differential medium
 - e. Selective medium
8. Scientific Inquiry - field visit to different ecosystem for sample collection
9. Enumeration of bacteria from environmental samples (Soil, Water and Air)
10. Determination of microorganisms by direct count and viable count

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1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, NewAgeInternationalPublishers,Chennai.
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B.Sc., MICROBIOLOGY
SEMESTER II
CORE PRACTICAL - II
MICROBIALPHYSIOLOGY

1. Pure culture techniques: streak, spread and pour plate methods
2. Motility determination - Hanging drop method, semisolid agar
3. Culture characteristics of Microorganisms- colony morphology, shape, margin.
4. Staining of microorganisms. – Grams staining, AFB staining, Capsular staining and spore staining
5. Biochemical test- IMViC test, Oxidase test, Catalase test, Urease test, Nitrate reduction test
6. Enzymatic Hydrolysis of Starch, Gelatin, Casein.
7. Bacterial Growth curve.
8. Studying the effect of temperature, pH, carbon and nitrogen sources on bacterial growth.
9. Anaerobic cultivation- candle jar, gas pack method.

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1. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, NewAgeInternationalPublishers,Chennai.PriceRs.225/-.
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B.Sc., MICROBIOLOGY
SEMESTER II
CORE PRACTICAL - III
MICROBIAL GENETICS AND MOLECULAR BIOLOGY

1. Isolation of Genomic DNA from Bacteria
2. Electrophoresis- Agarose gel electrophoresis,
3. Poly Acrylamide Gel Electrophoresis (PAGE)
4. Estimation of DNA by DPA method.
5. Restriction digestion of DNA
6. Isolation of Auxotrophic mutants from Soil sample by Replica plating.
7. Isolation of spontaneous mutants by Gradient plate technique.
8. Isolation of phage from Sewage (Demonstration)
9. PCR amplification - Demonstration.

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1. Rajan Sand Selvi Christy (2011). Experimental procedures in life sciences. Anjana Book House, publishers and distributors, Chennai
2. Aneja KR (2005). Experiments Microbiology, Plant pathology and Biotechnology. Fourth edition, New Age International Publishers, Chennai.
3. Dubey RC and Maheswari DK (2004). Practical microbiology First edition, S Chand and Company Ltd., New Delhi.
4. James G Cappuccino and Natalie Sherman (2004). Microbiology : A laboratory manual. Sixth edition, Published by Pearson Education.
5. Kannan N (2003). Handbook of laboratory culture media, Reagents, Stains and buffers. Panima Publishing Corporation, New Delhi.
6. https://www.researchgate.net/publication/280111071_Microbiology_Microbial_Genetics_Molecular_Biology_and_Biochemistry
7. <https://www.asmscience.org/content/book/10.1128/9781555817480>

B.Sc., MICROBIOLOGY
SEMESTER IV
CORE PRACTICAL - IV
IMMUNOLOGY AND IMMUNOTECHNOLOGY

1. Collection and Separation of serum/plasma from blood.
2. Serological tests:
 - a. Blood grouping- A,B,O, Rh
3. Blood cell count: RBC count, WBC count – total and differential.
4. Erythrocyte sedimentation rate
5. Agglutination reaction :
 - a. Widal test, RA test, CRP test
 - b. Pregnancy test (Slide and Card test)
6. Ouchterlony double immunodiffusion test.
7. Immunoelectrophoresis
8. Counter current immunoelectrophoresis
9. HIV - Tri Dot test and Hepatitis- Hepacard

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2. HaroldJBenson(1998).MicrobiologicalApplications-Laboratory Manualin General Microbiology. SeventhInternationaledition,MeGrew-Hill,Boston.
3. Myer's and Koshy's manual of diagnostic procedures in medical microbiology and immunology / serology. Published by department of clinical microbiology, CMC and Hospital, Vellore, TamilNadu.
4. The HiMedia Manual (2003). For microbiology and Cell Culture Laboratory Practice. Published byHiMediaLaboratories(P)Ltd.,Mumbai.
5. Mukherjee, L. (1997). Medical Laboratory Technology. Volume I & II. Tata McGrew-Hill PublishingCompanyLimited,New Delhi.
6. https://www.researchgate.net/publication/280733624_A_TEXT_BOOK_OF_IMMUNOLOGY_AND_IMMUNOTECHNOLOGY
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B.Sc., MICROBIOLOGY
SEMESTER V
CORE PRACTICAL - V
MEDICAL AND FOOD MICROBIOLOGY

1. Collection and processing of medical samples (Urine, pus and faces)
2. Isolation and identification of pathogenic bacteria from clinical specimens
 - a. *Staphylococcus aureus*
 - b. *Escherichia coli*
 - c. *Klebsiella pneumoniae*
 - d. *Salmonella typhi*
 - e. *Proteus vulgaris*
 - f. *Pseudomonas aeruginosa*
3. Isolation and identification of clinically important fungi- *Candida albicans*, *Aspergillus* sp, and *Cryptococcus neoformans*
4. Blood smear examination for malaria parasite (*Plasmodium vivax* and *Plasmodium malariae*)
5. Antibiotic susceptibility test: disc diffusion method and Determination of minimal inhibitory concentration (MIC)
6. Microscopic examination for parasite from Stool samples by Zinc-sulphate floatation method.
7. Staining Techniques (Grams and LPCB)–Food samples- vegetables and packed foods.
8. Isolation and identification of food born pathogen from spoiled and contaminated food/Vegetable samples.
9. Milk quality test (Methylene blue reductase assay, Resazurin test.).

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3. Kannan N (1996). Laboratory Manual in General Microbiology. First edition, Palani Paramount Publications, Palani. Tamil Nadu.
4. Harold J Benson (1998). Microbiological Applications - Laboratory Manual in General

Microbiology. Seventh International edition, McGraw-Hill, Boston.

5. Bailey & Scott's (2014). Diagnostic Microbiology. 13th edition, The C. V. Mosby Company.
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B.Sc., MICROBIOLOGY

SEMESTER VI

CORE PRACTICAL - VI

AGRICULTURE, ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY

1. Examination of plant diseases - Blight of rice, Citrus canker, Red rot of sugarcane, Wilt of cotton and Tikka leaf spot, Rust in groundnut
2. Isolation of Nitrogen fixing bacteria from root nodules of legumes and Rhizosphere soil
3. Isolation of Phosphate solubilizers from Agricultural Soil.
4. Enumeration of Microbes from air by open plate method.
5. Microbial analysis of Drinking water (MPN)
6. Immobilization of microbial cells (Baker's yeast)
7. Production of ethanol & wine from grapes.
8. Production and characterization of citric acid using *A. Niger*
9. Production of Extra cellular enzymes – Amylase by fermentation
10. Demonstration of batch fermentation using Erlenmeyer flask

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2. Aneja K. R (2005). Experiments Microbiology, Plant pathology and Biotechnology. Fourth edition, New Age International Publishers, Chennai.
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4. Harold J Benson (1998). Microbiological Applications - Laboratory Manual in General Microbiology. Seventh International edition, McGraw-Hill, Boston.
5. Subba Rao NS (2004). Soil Microbiology. Fourth edition, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. <http://www.scientificpub.com/book-details/Applied-Microbiology-Agriculture-Environmental-Food-and-Industrial-Microbiology-HB-792.html>
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