THIRUVALLUVAR UNIVERSITY
BACHELOR OF SCIENCE
B.Sc. MICROBIOLOGY
DEGREE COURSE
(With effect from 2022 - 2023)

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components Course Title		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		SEMESTER I					**CIA**	**Uni. Exam**	**Total**
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	**Communicative English I**	25	75	100
3.	III	Core Theory	Paper-1	6	4	Fundamentals of Microbiology	25	75	100
	III	Core Practical	Practical-1	4	0	Experiments in Basic Microbiology	0	0	0
4.	III	Allied -1	Paper-1	4	3	Biochemistry - I	25	75	100
	III	Allied- 1	Practical-1	2	0	Biochemistry	0	0	0
5.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English I**	**25**	**75**	**100**
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		**36**	**20**		**150**	**450**	**600**
		SEMESTER II							
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	4	4	**Communicative English II**	25	75	100
9.	**II**	**NMSDC I : Language Proficiency for Employability**	**Paper-1**	**2**	**2**	**Effective English**	**25**	**75**	**100**
10.	III	Core Theory	Paper-2	5	4	Microbial Physiology	25	75	100
11.	III	Core Practical	Practical-1	3	2	Experiments in Basic Microbiology (Contd.)	25	75	100
12.	III	Allied-1	Paper-2	4	3	Biochemistry - II	25	75	100
13.	III	Allied Practical - 1	Practical-1	2	2	Biochemistry (Contd.)	25	75	100
14.	**III**	**PE**	**Paper 1**	**6**	**3**	**Professional English II**	25	75	100
15.	IV	Value Education		2	2	Value Education	25	75	100
16.	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		**36**	**27**		**225**	**675**	**900**
		SEMESTER III							
17.	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
18.	II	English	Paper-3	6	4	English	25	75	100
19.	III	Core Theory	Paper-3	4	4	Immunology	25	75	100
	III	Core Practical	Practical-2	3	-	Experiments in Immunology and Microbial Genetics	0	0	0
20.	III	Allied-3	Paper-3	4	3	Bioinstrumentation	25	75	100

		Allied Practical - 2	Practical-2	3	-	Bioinstrumentation and Biostatistics	0	0	0
21.	IV	Skill Based Subject	Paper-1	2	2	Haematology and Blood Banking	25	75	100
22.	IV	Non-Major Elective	Paper-1	2	2	Microbes in Human Welfare	25	75	100
		Sem. Total		**30**	**19**		**150**	**450**	**600**
		SEMESTER IV							
23.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
24.	II	English	Paper-4	6	4	English	25	75	100
25.	III	Core Theory	Paper-4	4	4	Microbial Genetics	25	75	100
26.	III	Core Practical	Practical-2 (Contd.)	3	3	Experiments in Immunology and Microbial Genetics (Contd.)	25	75	100
27.	III	Allied-4	Paper-4	4	3	Biostatistics	25	75	100
28.	III	Allied Practical - 2	Practical-2 (Contd.)	3	2	Bioinstrumentation and Biostatistics (Contd.)	25	75	100
29.	**IV**	**NMSDC II : Digital Skills for Employability**	**Paper-2**	**2**	**2**	**Office Fundamentals**	**25**	**75**	**100**
30.	IV	Non-Major Elective	Paper-2	2	2	Emerging Microbial Diseases	25	75	100
		Sem. Total		**30**	**24**		**200**	**600**	**800**
		SEMESTER V							
31.	III	Core Theory	Paper-5	6	6	Medical Bacteriology and Mycology	25	75	100
32.	III	Core Theory	Paper-6	6	5	Agricultural and Environmental Microbiology	25	75	100
33.	III	Core Theory	Paper-7	5	5	Food Microbiology	25	75	100
	III	Core Practical	Practical-3	4	-	Experiments in Medical Microbiology	0	0	0
	III	Core Practical	Practical-4	4	-	Experiments in Applied Microbiology	0	0	0
34.	III	Internal Elective	Paper-1	3	3	(to choose one out of 3) A. Immunotechnology B. Human anatomy and physiology C. Cell Biology	25	75	100
35.	IV	Skill Based Subject	Paper-2	2	2	Mushroom Cultivation	25	75	100
		Sem. Total		**30**	**21**		**125**	**375**	**500**
		SEMESTER VI							
36.	III	Core Theory	Paper-8	6	6	Medical Virology and Parasitology	25	75	100
37.	III	Core Theory	Paper-9	5	5	Industrial Microbiology	25	75	100
38.	III	Core Practical	Practical-3	3	3	Experiments in Medical Microbiology (Contd.)	25	75	100
39.	III	Core Practical	Practical-4	3	3	Experiments in Applied Microbiology (Contd.)	25	75	100
40.	III	Compulsory Project	Paper-10	5	5	Group/Individual Project	25	75	100
41.	III	Internal Elective	Paper-2	3	3	(to choose one out of 3)	25	75	100

						A. Biotechnology B. Herbal Technology C. Genetic Engineering			
42.	III	Internal Elective	Paper-3	3	3	(to choose one out of 3) A. Bioinoculants Technology B. Clinical Microbiology C. Food analysis and quality control	25	75	100
43.	IV	Skill based Subject	Paper-3	2	2	Medical Laboratory Techniques	25	75	100
44.	V	Extension Activities		-	1	-	100	0	100
45.		**NMSDC III : Employability Readiness**		**0**	**0**	**(choose any one)** • **Naandi** • **Unnati** • **Quest** • **Izpay** • **IBM Skills build**	**-**	**-**	
		Sem. Total		**30**	**31**		**300**	**600**	**900**
					142				**4400**

Programme Specific Outcomes:

1. To provide an insight on the fundamentals of Microbiology
2. To enable the students to learn the biology of microorganisms
3. To practice continuous learning to improve knowledge
4. To use basicmicrobial technologies and methods for skill development
5. To use current microbial technologies and methods to improve healthy life
6. To use current microbial technologies and methods to create a better environment
7. To prepare students for promising career options in the field of microbiology
8. To apply the knowledge in day to day life
9. To have an understanding of professional responsibility
10. To have an ability to function in multidisciplinary working atmosphere

THIRUVALLUVAR UNIVERSITY, VELLORE – 632 115
B.Sc. MICROBIOLOGY – 2022-2023 onwards

Semester: I Paper type: Core

Paper code: Name of the Paper: FUNDAMENTALS OF MICROBIOLOGY

Credit: 4

Total Hours per Week: 6 Lecture Hours: 90 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To provide an insight on the fundamentals of Microbiology and microbes as a major component of the ecosystem

Course Out Comes

1. After studying unit-1, the student will be able to Understand the scope and relevance of Microbiology as a scientific discipline

2. After studying unit-2, the student will be able to Decide on the correct type of microscopy and staining

3. After studying unit-3, the student will be able to Gain knowledge on the various classification of microorganisms

4. After studying unit-4, the student will be able to Study the morphology and structure of microorganism

5. After studying unit-5, the student will be able to Get acquainted with various sterilization techniques

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

History of Microbiology - Definition and Scope of Microbiology; History of Microbiology; The origin of Microbial life - Theory of Spontaneous generation; Contributions of Anton Van Leewenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Thomas J. Burrill, Sergei N.

Winogrdsky, Beijerinck, Emil Christian Hansen, S.A. Waksman, Alexander Fleming; Endosymbiotic theory; Microbiology and the future.

UNIT - II

Microscopy and staining - Microscopy - Simple, Compound, Dark field, Phase contrast, Fluorescence and Electron microscopy; Staining methods and principles - Simple, Differential (Grams staining) and Special staining techniques (Acid fast staining, Spore staining, Capsule staining, Flagellar staining, Negative staining, Staining of metachromatic granules).

UNIT - III

Classification of microorganisms - Microbial Diversity - Prokaryotes and Eukaryotes; Binomial nomenclature of Microbes; Classification – Three Kingdom, Five Kingdom, Eight Kingdom (Cavalier Smith) Concepts; Bacterial classification according to Bergey's Manual; Classification outlines of Algae, Fungi, Protozoa and Virus.

UNIT - IV

Structure of microorganisms - Morphology and Anatomy of bacteria - cell wall, cytoplasmic membrane, capsule, cilia, fimbriae and flagella - structure and types, intracellular organelles and cytoplasmic inclusions; Endospore – sporulation.

UNIT - V

Concept of sterilization - Control of microbial growth by Sterilization and Disinfection – Definitions, methods; Physical, Chemical methods – Antiseptics; Antimicrobial agents – Antibacterial, antifungal and antiviral agents with examples – Resistance mechanisms.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Microbiology. 6th Edition. Pelczar Jr. M.J., Chan E.C.S and Kreig, N.R. (2006). McGraw Hill Inc., New York.
2. Text Book of Microbiology. 9th edition. Ananthanarayan R and Paniker C.K.J. (2013). Universities Press, Hyderabad.
3. A Text of Microbiology. Revised edition. Dubey R.C and Maheswari D.K. (2012). S. Chand & Company Ltd., New Delhi.

Reference books

1. Microbiology. 8th Edition. Lansing M. Prescott, John P. Harley, Donald Klein. (2011). McGraw Hill Inc., New York.
2. General Microbiology. 2nd Edition. Robert F. Boyd (2000). Times Mirror / Moshy College Publishing, Virginia.
3. Principles of Microbiology. 1st Edition. Geeta Sumbali and Mehrotra R.S (2009). Tata McGraw Hill P. Ltd., New Delhi.
4. Microbiology. 5th edition. David B.D., Delbeco R., Eisen, H.N. and Ginsburg, H.S (1990). Harper and Row, New York.
5. Fundamental Principles of Bacteriology, 7th edition. Salee A.J (1992). McGraw Hill Publishing Co. Ltd., New York.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: II Paper type: Core

Paper code: Name of the Paper: MICROBIAL PHYSIOLOGY
Credit: 4

Total Hours per Week: 5 Lecture Hours: 75 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To provide an in depth understanding on the physiological requirements for the growth of microorganisms and microbial metabolism

Course Out Comes

1. After studying unit-1, the student will be able to Outline on the nutritional requirement and nutritional types of bacteria.

2. After studying unit-2, the student will be able to Demonstrate various techniques employed in the cultivation of microorganisms

3. After studying unit-3, the student will be able to Discuss on the different phases of microbial growth

4. After studying unit-4, the student will be able to Explain the basic concepts of microbial metabolism

5. After studying unit-5, the student will be able to Elaborate on the biosynthesis of bacterial cell wall and mechanism of photosynthesis

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Nutritional requirements of microorganisms – micro and macro elements; Nutritional types of microorganisms - Autotrophs, Heterotrophs, Photoautotrophs, chemoautotrophs, Lithotrophs, oligotrophs; Transport of nutrients by active and passive transport mechanism.

UNIT - II

Cultivation of microbes - Bacteria, Fungi and Virus; Preparation of Culture media – types of culture media, liquid and solid media preparation; Pure culture techniques - Streak, Pour and spread plate methods; Preservation of cultures.

UNIT - III

Different phases of growth curve - generation time; Factors influencing microbial growth - oxygen, temperature, pH, pressure, salt concentration, nutrient; synchronous growth and continuous cultivation - diauxic growth.

UNIT - IV

Metabolism – TCA cycle - electron transport chain - oxidative and substrate level phosphorylation; Bacterial enzymes; Anaerobic respiration - Sulphur, nitrogenous compounds and carbon dioxide as final electron acceptor; Fermentations - alcoholic, propionic and mixed acid fermentation.

UNIT - V

Photosynthesis - Oxygenic and anoxygenic carbon dioxide fixation; Biosynthesis of bacterial cell wall; biosynthesis of amino acids (glutamic acid family); Bioluminescence.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Microbiology, 5th Edition. Pelczar Jr. M.J. Chan. E.C.S and Kreig. N.R (2006). McGraw Hill Inc. New York.
2. Essentials of Microbiology. Rajan. S and Selvi Christy (2015). Anjanaa Book House Publishers, Chennai.
3. The Physiology and Biochemistry of Prokaryotes. 4th edition. David white (2011). Oxford university press, UK.

Reference books

1. General Microbiology, Schlegel H.G., (1993, 7th Edition), Cambridge University Press.
2. Microbial physiology, 4th edition. Moat G, John W. Foster and Michael P. Spector (2002). A John Wiley sons, Inc. publication. New Delhi.
3. Microbiology. 8th Edition. Lansing M. Prescott, John P. Harley, Donald Klein. (2011). McGraw Hill Inc., New York.
4. Fundamental Pinciples of Bacteriology, 7th edition. Salee A.J (1992). McGraw Hill Publishing Co. Ltd., New York.
5. Microbial Physiology & metabolism, Caldwell, D.R., (1995) Wm. C. Brown Communications, Inc., USA.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	M	S	M	S
CO2	M	S	M	S	S	S	M	S	S	M
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	M	M	M	M	M

CO5	S	S	M	S	S	M	S	M	M	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: II Paper type: Practical

Paper code: Name of the Paper: EXPERIMENTS IN BASIC MICROBIOLOGY

Credit: 2
Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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Course Objectives

1. To familiarize the students with microbial world
2. To enable the students to perform sterilization of glasswares
3. To prepare culture media and sterilize them
4. To stain and observe various microorganisms
5. To perform biochemical test to differentiate bacteria

Course Out Comes

After completing the course, the student will be able to

1. observe microorganisms by staining
2. demonstrate motility of bacteria
3. determine the size of microorganisms
4. prepare culture media
5. demonstrate the biochemical activity bacteria

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

LIST OF EXPERIMENTS

Rules and Regulations in Microbiology Laboratory Safety precautions

Preparation of cleaning solutions

Sterilization of Glasswares and Culture Media

Microscopy – Parts and functions of a compound microscope

Staining – Simple staining, Gram staining

Motility demonstration: Hanging drop technique

Morphology of Algae – wet mount

Morphology of fungi – LPCB staining

Micrometry - Determination of size of Bacteria, yeast.

Media preparation - Liquid media, solid media, Agar slants, Agar plates

Pure culture technique - Streak plate

Oxidase and catalase tests

Biochemical tests - IMViC tests, urease test, TSI, Carbohydrate fermentation

Internal Assessment Methods:

- Regularity in lab course
- Performance assessment in each eaxperiment
- Viva voce
- Submission of Observation report
- Model practical exam

Reference Manuals

1. Rajan. S and Selvi Christy (2015). Experimental Procedures in Life Sciences, Anjanaa Book House Publishers, Chennai.

2. Cappuccino and Sherman. Microbiology: A Laboratory manual by (7^{th} edition) Berjamin Cummings Publications, 2004.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	S	M	S	S	S	M	S	M	S
CO2	M	S	M	S	M	S	S	S	S	S
CO3	S	M	S	S	M	S	S	S	S	M
CO4	S	S	M	S	S	S	M	M	S	M

CO5	S	S	M	S	M	S	S	S	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: III Paper type: Core

Paper code: Name of the Paper: IMMUNOLOGY
Credit: 4

Total Hours per Week: 4 Lecture Hours: 60 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To enable students to understand immune system, immunity and their implication on health and disease

Course Out Comes

1. After studying unit-1, the student will be able to Outline the history and scope of Immunology.

2. After studying unit-2, the student will be able to Explain the structure, functions and properties of immune cells

3. After studying unit-3, the student will be able to Compare the different types of antibodies and relate them to antigens

4. After studying unit-4, the student will be able to Comprehend on the complement system and Major histocompatibility complex

5. After studying unit-5, the student will be able to Familiarize with immunehaematology and hypersensitivity reaction

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I
History and scope of Immunology. Types of Immunity - Innate and Acquired immunity - Active, Passive, Humoral and Cell Mediated Immunity.

UNIT - II
Structure, Functions and Properties of Immune Cells - Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs - Bone Marrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT.

UNIT - III

Antigens - Types, Characteristics of antigen, Haptens, Epitopes (T & B cell epitopes), Factors influencing antigenicity. T-dependent and T-independent antigens; Adjuvants. Antibodies - Structure, types, properties and functions of immunoglobulins.

UNIT - IV

Complement system - Structure, Components, Properties and Functions, Pathways of Complement activation. Major Histocompatibility complex proteins (MHC) – Definition, Types, physiological role, Antigen processing and presentation.

UNIT - V

Immunohaematology - Blood cell components, ABO blood grouping, RH typing, Pre-transfusion testing, Antibody detection, Cross matching, Investigation of immune hemolysis, Perinatal screening blood test. Hypersensitivity and Allergic reactions - Immediate and Delayed type, Methods to detect hypersensitivity.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Immunology. 6th edition. Kuby J, Richard A. Goldsby, Thomas J. Kindt (2006). W.H. Freeman and company, New York.
2. Immunology. 3rd edition. Richard M. Hyde (2011). Williams & Wilkins, *Philadelphia.*
3. Immunology. An Introduction. 1st edition. Tizard K (1995). Saunders college publishing, Philadelphia.

Reference books

1. Roitts Essential Immunology. 13th edition. Peter J. delves, Seamus J. Martin, Dennis R. Burton & Ivan M. Roitt (2017). Wiley- Blackwell publishers, United States.
2. Cellular and Molecular Immunology. 9th edition. Abbas Abut K, Lightman Andrew K. and Pober Jordan S. (2017). Elsevier, Netherlands.
3. Fundamental Immunology, 7th edition. William E. Paul. (2012). Lippincott Williams and Wilkins, Philadelphia.
4. Immunology, 10th edition. Weir D.M and Stewart, J. (2000). Churchill Livingston, New York 2000.
5. Text Book of Immunology. 1st edition. Bashir S.F (2011). PHI Learning Private limited, New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

CO1	S	M	M	M	M	S	M	S	M	S
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	S	M	M	S	M
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: III Paper type: Skill based subject

Paper code: Name of the Paper: HAEMATOLOGY AND BLOOD BANKING

Credit: 2

Total Hours per Week: 2 Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To learn the collection and processing of blood samples, perform blood group

Course Out Comes

1. After studying unit-1, the student will be able to Discuss in detail the collection and processing of blood

2. After studying unit-2, the student will be able to Understand the appropriate methods of diagnosis and management of disorders

3. After studying unit-3, the student will be able to Understand how to diagnose and manage hematological disorders and blood parasites

4. After studying unit-4, the student will be able to Appreciate the various types of blood group systems

5. After studying unit-5, the student will be able to Know the methods of preservation, storage and transportation of blood to distant places

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

COLLECTION OF BLOOD CELLS - Blood: Definition, Characters, Composition. Collection of Blood - Capillary Blood from Adults/Infants, Examinations employed, Advantages/Disadvantages - venous blood from Adults/Infants, Examinations employed, Advantages/Disadvantage. Anticoagulants: Definition - Type: Wintrobes /EDTA /Heparin /Citrate, Concentration, Examinations, Advantages /Disadvantage.

UNIT - II

COUNTING OF BLOOD CELLS: Neubaeur counting chamber - Total RBC count : diluting fluids, Macro dilution / Micro dilution technique, Falsely Law and High Counts, Normal values - Total WBC count: diluting fluids, Macro dilution / Micro dilution technique, Falsely Law and High Counts, Normal values - correction for TWBC - Absolute Eosinophil count - Differential Leucocyte count: Granulocyte / Agranulocytes, Morphology / Function, Staining Technique - Platelet Count: Morphological characters / Functions, Direct /Indirect method - Reticulocyte count, Dry/ Wet smear technique. Haemoglobin: Composition /Normal Values: Determinations.

UNIT - III

COAGULATION MECHANISM: Factors: Bleeding time, Clotting time. Halmotological indices: - Packed cell volume: Wintrobes / Micro HCT method - Mean corpuscular Volume - Mean corpuscular haemoglobin - Mean Corpuscular haemoglobin concentration - Volume index - volume thickness index - Mean corpuscular diameter - saturation index. Erythrocyte sedimentation etc, Principle-Determination: wintrobes / Westegren Method - advantages / disadvantages.

UNIT - IV

PREPARATIONS OF STAINS AND STAINING TECHNIQUES OF BLOOD SMEAR: Wright stain - Leishmans stain - Giemsa's stain - Jaswanthsingh and Bhattarcharji stain - Fields stain - Peroxidase stain: Examination of Blood smear:-Peripheral smear report: Size/ colour/ shapes/ inclusions - Blood parasites: Malarial parasite/Microfilaria.

UNIT - V

BLOOD BANKING: ABO Grouping; History/Discovery - slide / Tube technique - Rh. Typing: Slide / Tube technique, Bovine replacement technique - Coombs test: Direct /Indirect - Donor screening - Cross matching: Major / Minor - Blood bank practices - Collection of blood / preservation /storage.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Medical Laboratory Technologies Vol I - III. Mukerjee, K.L. (1988). Tata McGraw Hill. Publishers, New Delhi.
2. Basic & Applied Concepts of Blood Banking and Transfusion Practices. 4th edition, Paula R. Howard (2016). Mosby publishers, United States

Reference Books

1. A text book of Practical Physiology, 4th Edition. Pal, G.K and Pravathi Pal (2016). Universities Press (India) Pvt Ltd.
2. Laboratory Procedures in Haematology, 1st edition. Mehdi S.R (2006). Jaypee Publishers.

3.Textbook of Medical Laboratory Technology 2 Volume Set, 3rd Edition. 2014. Gadkar P.B and Gadakar D.P. Bhalani Publishing House, Mumbai India.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: III Paper type: Non-Major elective

Paper code: Name of the Paper: MICROBES IN HUMAN WELFARE
Credit: 2
Total Hours per Week: 2 Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To learn the various significant uses of microorganisms in human welfare

Course Out Comes

1. After studying unit-1, the student will be able to Understand the scope and relevance of Microbiology in daily life

2. After studying unit-2, the student will be able to Gain knowledge on the various types of microorganisms

3. After studying unit-3, the student will be able to Understand the potential of microorganisms

4. After studying unit-4, the student will be able to Appreciate the beneficial aspects of microorganisms

5. After studying unit-5, the student will be able to Get acquainted with various ways of using microorganisms

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Definition and Scope of Microbiology - The five major groups of microorganisms - Brief history of Microbiology - Theory of Spontaneous generation - Microscopy and staining - Concepts like Pure culture, culture media, fermentation - Bacterial growth, exponential multiplication, nutrients required for microbial growth - Photosynthetic microorganisms - bacteria, algae, cyanobacteria

UNIT - II

Household fermented foods - Idly, Pickles; Fermented milk products - Single Cell Proteins - Mushrooms

UNIT - III
Microbial production of organic acids, alcohols, enzymes, antibiotics, pigments, Biopolymers

UNIT - IV
Biofertilizers and biopesticides; Seaweeds and their uses; Microalgae and their uses - *Spirulina*; Biodegradation of Organic pollutants, Heavy metals, Plastic Degradation

UNIT - V
Concept of immunization and Vaccines, Immunoglobulins as therapeutic agents - Microorganisms as model organisms in genetic studies; Probiotics

Internal Assessment Methods:
Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text books
1. Microbiology. 6th Edition. vMcGraw Hill Inc., New York.
2. x A Text of Microbiology. Revised edition. Pelczar Jr. M.J., Chan E.C.S and Kreig, N.R. (2006). S. Chand & Company Ltd., New Delhi.

Reference books
1. Microbiology. 5th edition. David B.D., Delbeco R., Eisen, H.N. and Ginsburg, H.S (1990). Harper and Row, New York.
2. Industrial Microbiology. 3rd edition. Patel A.H (2001). Mac Millan India ltd, New Delhi.
3. Industrial Microbiology. 2nd edition. Casida J.E (2005). Wiley Blackwell publishers, UK

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: IV Paper type: Non-Major elective

Paper code: Name of the Paper: MICROBIAL GENETICS

Credit: 4
Total Hours per Week: 4 Lecture Hours: 60 Tutorial Hours: Nil Practical Hours: Nil

……

Course Objectives

To provide an insight on the genomic structure, its organization and regulation, methods of gene transfer in bacteria and to familiarize on the concept of mutation.

Course Out Comes

1. After studying unit-1, the student will be able to Outline the structure, replication and function of DNA

2. After studying unit-2, the student will be able to Explain about mutation, types of mutation and DNA repair mechanism

3. After studying unit-3, the student will be able to Elaborate the different gene transfer methods in bacteria

4. After studying unit-4, the student will be able to Compile the gene regulation in prokaryotes and eukaryotes

5. After studying unit-5, the student will be able to Describe transposons and gene mapping

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Discovery of DNA as genetic material, Griffith's experiment, Hershy and Chase Warring blender experiment; Structure of DNA; Plasmids - types and significance; Replication of DNA - Messelson and Stahl's Experiment - Types of replication - DNA polymerases; Triplet nature of the Genetic code.

UNIT - II

Mutation - Spontaneous mutation - missense, nonsense and frame shift mutation; Induced mutation - Mutagens - UV, X-Rays - Chemical agents - NTG and Base Analogues, Reversion - AMES Test, DNA damage - SOS response - DNA repair.

UNIT - III

Transcription, Translation; Concept of Gene and operon; Gene transfer Mechanisms - Transformation, Conjugation, Transduction - Generalized and specialized.

UNIT - IV

Gene regulation in prokaryotes and eukaryotes, positive regulation, negative regulation, attenuation - Gene expression system - Lactose and tryptophan operon. RNA structure and RNA processing - post transcriptional regulation. Transcriptional and translational regulation. Post translational modification and protein stability.

UNIT - V

Transposable genetic elements and Gene Mapping - Introduction - Discovery, insertion sequences, complex and compound transposons - T10, T5, and retroposon. Genetic mapping - *E. coli* - Virus T4 phage - using r II system.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Microbial Genetics. Stanley R Maloy, John E Cronan and David Freifelder. 2nd Edition 1994. Jones and Bartlett Publishers, Boston.
2. Principles of Genetics. 7th edition. Robert H Tamarin (2002). Tata McGraw Hill P. Ltd., New Delhi.
3. Instant Notes in Molecular Biology, 2001, (2nd Edition). Turner P. C., Mc Lennan A. G., Bates A. D and White M. R. H. Published by arrangement with Bios Scientific Publishers Ltd., Oxford.

Reference books

1. Modern Microbial Genetics, 2002 (2nd Edition). Streips, U. N. and R. E. Yasbin. Wiley-Liss, Inc., New York.
2. Principles of Genetics. 8th edition. Gardner Simion Snustad (2005). John Wiley and Sons Inc, New York.
3. Gene VII, 7th Edition, 2000. Benjamin Lewin. Oxford University Press.
4. Genetics: A Conceptual Approach. Benjamin A. Pierce (2002). W.H.Freeman and Company, United States.
5. Advanced Molecular Biology - A concise Reference. Twyman, R M. 1998, Viva Books Private Ltd., New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: IV Paper type: Practical

Paper code: **Name of the Paper: EXPERIMENTS IN IMMUNOLOGY AND MICROBIAL GENETICS**

Credit: 3

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

……

Course Objectives

1. To separate Serum and Plasma from blood
2. To perform blood grouping
3. To observe blood smear
4. To perform immune diffusion
5. To isolate antibiotic resistant bacteria

Course Out Comes

After completing the course, the student will be able to

1. separate Serum and Plasma from blood
2. identify blood groups
3. do differential Count of blood cells
4. perform immune diffusion
5. demonstrate antibiotic resistant bacteria

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

LIST OF EXPERIMENTS

Separation of Serum and Plasma

Demonstration of buffy coat

Blood grouping

ASO test

RPR test

Widal slide test

Preparation of blood smear and observation of WBC

Differential Count – Blood smear

Single radial immune diffusion

Double immuno diffusion

Isolation of antibiotic resistant bacteria by induced mutation

Internal Assessment Methods:

- Regularity in lab course
- Performance assessment in each eaxperiment
- Viva voce
- Submission of Observation report
- Model practical exam

Reference Manuals

1. District Laboratory Practice in Tropical Countries - Part I and II 2nd Edition. Monica Cheesbrough. Cambridge University Press, New Delhi. 2006.

2. Practical Medical Microbiology. Mackie and McCartney. South Asia Edition. 14th edition. 2006.

3. Laboratory Exercises in Microbiology. Harley and Prescott (1996). McGraw Hill Higher Education, 3rd Edition

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: III Paper type: Skill-based subject

Paper code: Name of the Paper: MUSHROOM CULTIVATION

Credit: 2

Total Hours per Week: 2 Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

……

Course Objectives

To provide the necessary skills in Mushroom cultivation

Course Out Comes

1. After studying unit-1, the student will be able to Outline the structure, cultivation of mushroom

2. After studying unit-2, the student will be able to Explain about Spawn preparation

3. After studying unit-3, the student will be able to Elaborate the Cultivation of important Mushroom varieties

4. After studying unit-4, the student will be able to Appreciate the nutritional value of mushrooms

5. After studying unit-5, the student will be able to Describe the economic aspects of mushroom cultivation

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Introduction, History of Mushroom Cultivation- Morphology and life Cycle of Mushroom - Edible and Non-Edible Mushroom (Most commonly cultivated Mushrooms in the World, Distribution and Production in various Countries).

UNIT - II

Spawn; Types Spawn, Preparation of Spawn, Mushroom Bed Preparation and factors affecting Mushroom bed preparation, Compost: Materials used for Compost preparation , Compost Technology in Mushroom production- Casing; Raw material used for casing, preparation of Casing Material. Important Sanitation during various stages of Mushroom cultivation.

UNIT - III

Cultivation of important Mushroom: General process for the cultivation of *Agaricus bisporus* (White button Mushroom), *Pleurotus flabelltus* (Oyster Mushroom), *Volvariella volvaceae* (Paddy Straw Mushroom).

UNIT - IV

Mushroom nutritional value; (Proteins, Amino acids, Vitamins, Minerals, Carbohydrates) - Pests and diseases of Edible Mushrooms (Environmental, Fungal, Bacterial, Viral, Insect Pests and Nematode diseases and competitor Moulds.

UNIT - V

Economics of mushroom cultivation (fixed assets, recurring expenditure, labour, economics of cultivation throughout the year and seasonal growing formulation of project report for getting finance from funding agencies). Precautions in mushroom cultivation (precaution to be taken while selecting the area, spawn preparation, spawn run, during cropping harvesting etc.). Mushroom recipes (Western and Indian recipes, pickles, powders, jams etc)

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Mushroom production and processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
2. Mushroom - the art of cultivation, Harander Sing (1991). Sterling Publishers.
3. Biology and conservation of mushroom, Kaul T N (2001). Oxford and IBH Publishing Company, New Delhi.

Reference books

1. Changs Biology and cultivation of Mushrooms. . T.W.A. Hanyanes. 1978. Acad press. N.Y.
2. Edible Mushroom, Biotechnology. Vol. 3. Zadrazil. F & K. Grabbe. 1983. Weinheim: verlag Chemie, Berlin.
3. Handbook of Edible Mushrooms. Kannaiyan. 2001. TNAU Publication.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	S	S	S	M	S	M	S
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	S	M	S	S
CO4	S	S	S	S	S	M	M	S	S	S

CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: IV Paper type: Non-Major elective

Paper code: Name of the Paper: EMERGING MICROBIAL DISEASES
Credit: 2
Total Hours per Week: 2 Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

1. To understand the role of Microbiology in diseases

2. To get acquainted with various diseases caused by microorganisms

3. To gain knowledge on the various types of pathogenic microorganisms

4. To understand the mode of disease spread

5. To learn the methods of disease prevention

Course Out Comes

1. After studying unit-1, the student will be able to explain the mode of disease transmission

2. After studying unit-2, the student will be able to recognize and prevent diseases caused by bacteria

3. After studying unit-3, the student will be able to recognize and prevent fungal diseases

4. After studying unit-4, the student will be able to recognize and prevent parasitic diseases

5. After studying unit-5, the student will be able to understand and prevent viral diseases

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Diseases Vs Infections; Communicable versus Non-communicable diseases; Microbiology; Microorganisms - Pathogens; Transmission; Sources of infection - air, water, food, animals, hospitals; Diagnosis; Treatment - Antibiotics; Prevention - hygiene, vaccines

UNIT - II

Bacterial diseases - Symptoms, causative agent, diagnosis, treatment, prevention methods of tuberculosis, cholera, diarrhea, dysentery, typhoid, pertussis, diphtheria, tetanus, syphilis, gonorrhea, leptospirosis, plague, scrub typhus

UNIT - III

Fungal diseases - Symptoms, causative agent, diagnosis, treatment, prevention methods of candidiasis, aspergillosis, mycetoma, fungal eye infection, ringworm, athlete's foot, jock itch fungal nail infections

UNIT - IV

Parasitic diseases - Symptoms, causative agent, diagnosis, treatment, prevention methods of Malaria, Amoebic dysentery, leishmaniasis, filariasis

UNIT - V

Viral diseases - Symptoms, causative agent, diagnosis, treatment, prevention methods of Polio, Jaundice, Mumps, Measles, Chicken pox, Rabies, Dengue fever, Chikungunya, Japanese encephalitis, Influenza, SARS, Covid19, AIDS

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text books

1. Text Book of Microbiology. 9th edition. Ananthanarayan R and Paniker C.K.J. (2013). Universities Press, Hyderabad.
2. A Text of Microbiology. Revised edition. Dubey R.C and Maheswari D.K. (2012). S. Chand & Company Ltd., New Delhi.

Reference books

1. District Laboratory Practice in Tropical Countries - Part I and II. 2nd edition. Monica Cheesbrough. (2005). Cambridge University Press, New Delhi.
2. Microbiology. 6th Edition. Pelczar Jr. M.J., Chan E.C.S and Kreig, N.R. (2006). McGraw Hill Inc., New York.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	S
CO2	M	S	M	S	M	M	M	S	S	S
CO3	S	S	S	S	S	S	S	S	S	S
CO4	S	S	S	S	S	M	S	S	S	M

CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

SEMESTER V
Core Paper - 5

Semester: V Paper type: Core

Paper code: Name of the Paper: Medical Bacteriology and Mycology

Credit: 6
Total Hours per Week: 6 Lecture Hours: 90 Tutorial Hours: Nil Practical Hours: Nil

……

Course Objectives

To enable student to understand medically important bacteria and fungi that cause diseases in humans

Course Out Comes

1. After studying unit-1, the student will be able to outline the importance of Normal microbial flora of human body and Host-Parasite relationships.

2. After studying unit-2, the student will be able to explain about the diseases caused by the bacterial pathogens, prevention and treatment

3. After studying unit-3, the student will be able to discuss the different modes of transmission of bacterial diseases and the preventive measures

4. After studying unit-4, the student will be able to compare the morphological classification of fungi, and perform isolation of fungi from clinical specimen

5. After studying unit-5, the student will be able to compile the common mycotic diseases, their pathogenicity and various antifungal agents used for treatment

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Normal Microbial flora of human body. Host parasite relationship - Infection and types of infection (Primary, Secondary, Reinfection, cross infection, Nosocomial and Iatrogenic

infection) - Virulence factors of bacteria causing infection. Specimen collection, Transport and storage; Specimen processing (Blood, Urine, CSF, Sputum and other body fluids).

UNIT - II

Morphology, classification, antigenic structure, cultural characteristics, pathogenicity, laboratory diagnosis, preventive measures and treatment of Human pathogens - *Staphylococcus aureus, Streptococcus pyogenes, Streptococcus pneumoniae, Neisseriae meningitides* and *Neisseriae gonorrhoeae, Corynebacterium diphtheriae, Mycobacterium tuberculosis* and *Mycobacterium leprae,, Clostridium botulinum, Clostridium tetani* and *Clostridium perfringens, Bacillus anthracis*. Family - Enterobacteriaceae (*Escherichia coli, Klebsiella, Salmonella, Shigella* and *Proteus*).

UNIT - III

Morphology, classification, antigenic structure, cultural characteristics, pathogenicity, laboratory diagnosis, preventive measures and treatment of *Vibrio cholerae* and *Vibrio parahaemolyticus, Pseudomonas aeruginosa, Brucella abortus, Bordetella pertussis*, *Haemophilus influenzae*, *Treponema pallidum,* Chlamydiae and Rickettsiae - Hospital waste disposal.

UNIT - IV

General introduction, Morphology and classification of fungi of medical importance - Detection and recovery of fungi from clinical specimens. Yeasts of medical importance - *Candida albicans, Cryptococcus neoformans*.

UNIT - V

Dermotophytes and agents of superficial mycosis - *Trichophyton*, *Epidermophyton* and *Microsporum* - Dimorphic fungi causing systemic mycoses - Histoplasmosis, Coccidiodomycosis, Blastomycosis - Mycetoma - Antifungal agents.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Text Book of Microbiology, 9th edition. Ananthanarayan R & Paniker C.K.J. (2013). Universities Press, Hyderabad.
2. Medical Microbiology. 26th edition. Jawetz, Melnick, & Adelberg's. (2013). McGraw-Hill, New York.
3. An Introduction to Mycology. 1st edition. Mehrotra RS and Aneja KR. (2006). New age international publishers, Chennai.

Reference books

1. Diagnostic Microbiology, 13th edition. Tille P. Bailey and Scott (2013). Mosby Publishers, United States.
2. Medical Microbiology. 1st edition. Rajan S (2009). MJP Publishers, Chennai.

3. Essentials of Medical Microbiology. 3rd edition. Rajesh Bhatia and Ratan Lallchhpujani (2004). Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
4. District Laboratory Practice in Tropical Countries. Part 1 & 2, Monica Cheesbrough (2003). Cambridge University Press.
5. Jagadish Chander (1996). A text book of Medical Mycology. 1st edition. Interprint, New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: V Paper type: Core

Paper code: Name of the Paper: Agricultural and Environmental Microbiology

Credit: 5
Total Hours per Week: 6 Lecture Hours: 90 Tutorial Hours: Nil Practical Hours: Nil

……

Course Objectives

To enable students to understand the impact of microbial association in the field of Agriculture and the Environment

Course Out Comes

1. After studying unit-1, the student will be able to outline the physical, chemical properties and microflora of soil

2. After studying unit-2, the student will be able to explain the role of microorganisms in biogeochemical cycles

3. After studying unit-3, the student will be able to compile the significance of microbial interactions and phytopathogens

4. After studying unit-4, the student will be able to demonstrate the air sampling techniques and summarize on air borne pathogens

5. After studying unit-5, the student will be able to apply the processes involved in the treatment of municipal water supplies

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Soil - Physical properties of soil - Soil color, Soil moisture, Soil temperature, Soil structure, Bulk density of soil- Types of soil. Chemical properties of soil- pH, Electrical conductivity, Nitrogen, Phosphate, Potash - Microflora of soil.

UNIT - II

Role of Microorganism in Biogeochemical cycles - Carbon, Nitrogen, Phosphorus, Sulphur and Iron. Organic matter decomposition - Composting (aerobic and anaerobic) -Vermicompost production - Biopesticides (Bacterial, Viral and Fungal).

UNIT - III

Microbial interaction-Symbiosis, Mutualism, Commensalism, Ammensalism, Parasitism-Rhizosphere; Phyllosphere - Plant pathogens- Bacteria (*Xanthomonas* sp.), Fungus (*Fusarium* sp.), Virus (Tobacco Mosaic Virus)

UNIT - IV

Microbiology of air - Sources of Microorganisms in air - Assessment of air quality-Air sampling techniques - Enumeration of airborne organisms - Air borne diseases - Air sanitation.

UNIT - V

Aquatic Microbiology - Ecosystems - Fresh water (River, Ponds, Lakes, Streams) Marine, Esturies.Microbial assessment of water quality - Water purification.Water borne diseases. Waste Water treatment- Municipal waste water treatment primary, Secondary (Biological) and Tertiary.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Microbial Ecology, Fundamental and Application, 3rd edition. Atlas R.M. and Bartha R (1992). Bengamin and Cummings. United States.
2. Environmental Aspects of Microbiology. Joseph C. Daniel. Brightsun Publications. Chennai
3. Soil Microbiology. 4th edition. Subba Rao N.S (2004). Oxford and BH Publishing Co.Pvt. Ltd., New Delhi.

Reference books

1. Environmental Microbiology. 1st edition. Raina M. Maier, Ian L. Pepper, Charles, P. Gerba (2006). Academic press, United States.
2. Environmental Science and Biotechnology. 1st edition. Murugesan A.G and Rajakumari C (2005). MJP Publishers, Chennai.
3. Soil Microbiology. 1st edition. Mishra R.R (2004). CBS Publishers and distributors, New Delhi.
4. Disease of Crop Plants in India. 4th edition. Rangaswami G and Mahadevan A (2002). PHI Learning (P) Ltd., New Delhi.
5. Soil Microbiology. 1st edition. Robert L Tate (1995). John Wiley and Sons, Inc. New York.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: V Paper type: Core

Paper code: Name of the Paper: FOOD MICROBIOLOGY

Credit: 5
Total Hours per Week: 5 Lecture Hours: 75 Tutorial Hours: Nil Practical Hours: Nil

……

Course Objectives

To enable students to understand the beneficial and harmful association of microbes on food

Course Out Comes

1. After studying unit-1, the student will be able to Outline the important microorganisms present in food

2. After studying unit-2, the student will be able to Elaborate the principles and methods of food preservation

3. After studying unit-3, the student will be able to Compile the contamination, spoilage and spoilage of various foods

4. After studying unit-4, the student will be able to Demonstrate and prepare fermented foods

5. After studying unit-5, the student will be able to Summarize bacterial and non-bacterial food borne diseases

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Food as a substrate for microorganisms - important microorganisms associated with food (bacteria, mold and yeast). Factors affecting the growth of microorganisms in food -pH, moisture, oxidation - reduction potential , nutrient content and inhibitory substances and biological structure.

UNIT - II

Contamination and Spoilage of food - microorganisms involved in the spoilage of cereals, vegetables and fruits, egg, meat and meat products, poultry, sea foods and milk -canned foods; prevention of spoilage.

UNIT - III

Principles of food preservation - Methods of food preservation - Asepsis -techniques involved in removal of microorganisms from food - use of temperature - low temperature & high temperature - canning, drying, radiation and food additives.

UNIT - IV

Fermented foods -pickled cucumber, sauerkraut, soy sauce, bread, idli & Dosa; Fermented dairy products - kefir, yoghurt and cheese; health benefits of fermented foods.

UNIT - V

Food borne illness - Foodborne infections -Bacterial - food intoxication - bacterial toxins - Mycotoxins- investigation of food poisoning outbreaks. Food quality control measures - food standards & quality control. HACCP, FDA, WHO, FSSAI.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Food Microbiology. 4th edition. Frazier W.C. and West Hoff D.C (2008). McGraw Hill, New York.
2. Food Microbiology. 2nd edition. Adam M.R. and Moss M.O (2004). New international pvt. Ltd., publishers. UK.
3. Food Microbiology. 1st edition. Vijaya Ramesh K (2007). MJP Publishers, Chennai.

Reference books

1. Food Processing and Preservation. 8th edition. Sivashankar B and Mosses (2011). PHI Learning P. Ltd., New Delhi.
2. Basic Food Microbiology. 2nd edition. Banwart G. J (2004). CBS Publishers and Distributors, New Delhi.
3. Modern Food Microbiology. 4th edition. James M. Jay (2003). CBS Publishers, New Delhi.
4. Dairy Microbiology. Robinson R.K,(1990). Elseveir Applied science, London.
5. Principles of Fermentation technology. 1st edition. Stanbury P.F., Whitaker A and Hall S.J (1995). Pergamon, UK.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10

CO1	S	M	S	M	S	S	M	S	M	S
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	S	M	M	M	M
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: V Paper type: Elective

Paper code: Name of the Paper: A. IMMUNOTECHNOLOGY
Credit: 3
Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To introduce immunotechnology to students and make them familiar with Antigen - Antibody reactions

Course Out Comes

1. After studying unit-1, the student will be able to understand basic concepts of Immunotechnology

2. After studying unit-2, the student will be able to demonstrate Antigen - Antibody reactions

3. After studying unit-3, the student will be able to express the concept of Autoimmunity

4. After studying unit-4, the student will be able to explain the role of Cytokines

5. After studying unit-5, the student will be able to discuss the role of vaccines in preventing diseases

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Introduction and scope of Immunotechnology; Preparation and purification of antigens, Extraction of antigens from pathogens, Preparation of synthetic antigens, Recombinant antigens; Production, purification and characterization of antibodies, Purification of Immunoglobulin, Characterization of Immunoglobulin.

UNIT - II

Antigen - Antibody reactions - Agglutination, Precipitation, Passive agglutination, Complement fixation test, neutralization tests, Immunofluorescence, ELISA, RIA, Western blot analysis,

Immunoelectrophoresis, Flow cytometry, Chemiluminescence assay, Fluorescence activated cell sorting (FACS) analysis.

UNIT - III

Autoimmunity- Autoimmune diseases- Hashimoto's disease, Systemic lupus erythematosus, Multiple sclerosis, Myasthenia gravis and their treatment. Transplantation Immunology - Tissue transplantation - Tissue typing methods for tissue and organ transplantations. Graft versus host reaction and rejection, xenotransplantation.

UNIT - IV

Cytokines: Interferons, Interleukinsand TNF - Production, Properties, biological functions and assay methods. Therapeutic uses of cytokines.Hybridoma technology - Production of monoclonal antibodies and their applications, chimeric antibodies.

UNIT - V

Principle of Immunization - Active and Passive Immunization; Kinds of vaccines - live, killed, attenuated, Toxoids, Purified Macromolecules as Vaccines, subunit vaccines, recombinant vector vaccines, DNA vaccines, peptide vaccines, conjugate vaccines; Recommended childhood immunization schedule.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Immunology. 6th edition. Kuby J., Richard A. Goldsby, Thomas J. Kindt (2006). W.H. Freeman and company, New York.
2. Immunology. 3rd edition. Richard M. Hyde (2011). Williams & Wilkins, *Philadelphia.*
3. Immunology - An Introduction. 1st edition. Tizard K (1995). Saunders College Publishing, Philadelphia.

Reference books

1. Roitt's Essential Immunology. 13th edition. Peter J. delves, Seamus J. Martin, Dennis R. Burton& Ivan M. Roitt (2017). Wiley- Blackwell publishers, United States.
2. Cellular and Molecular Immunology. 9th edition. Abbas Abut K, Lightman Andrew K. and Pober Jordan S. (2017). Elsevier, Netherlands.
3. Fundamental Immunology, 7th edition. William E. Paul. (2012). Lippincott Williams and Wilkins, Philadelphia.
4. Immunology, 10th edition. Weir D.M & Stewart, J. (2000) Churchill Livingston, New York 2000.
5. Text Book of Immunology. 1st edition. Bashir S.F (2011). PHI Learning Private limited, New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: V Paper type: Elective

Paper code: Name of the Paper: B. HUMAN ANATOMY AND PHYSIOLOGY

Credit: 3

Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To study the structure and functions of various organs and systems of human body

Course Out Comes

1. After studying unit-1, the student will be able to Explain the organs and functions of Respiratory System

2. After studying unit-2, the student will be able to Outline the structure of organs of Gastro Intestinal System

3. After studying unit-3, the student will be able to Discuss about the Musculoskeletal and Nervous System

4. After studying unit-4, the student will be able to Describe the features of Circulatory system and Endocrine System

5. After studying unit-5, the student will be able to Compile the information on Reproductive and urinary System

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Introduction to applied human anatomy and physiology; **Respiratory System:** Different organs of the Respiratory System. Functions of the different organs of the Respiratory System. **Special Sensory Organs:** Introduction to special sensory organs. Function and functions of eye, ear, nose, tongue, and skin.

UNIT - II

Gastro Intestinal System: Different organs associated with the Gastro Intestinal system: (Salivary glands, Pancreas, Liver and Gall bladder and others).

UNIT - III

Musculoskeletal and skin: Introduction of musculo-skeleton system. Different parts of involved in skeleton system. Function of skeleton. Parts and function of skin. **Nervous System:** Introduction to nervous system. Different organs and function of central nervous system (CNS) and peripheral nervous system PNS and related to infection

UNIT - IV

Circulatory system: Blood - Site of formation, composition, functions of blood cells, Different parts of the circulatory system and its function. **Endocrine System:** Introduction to endocrine system.

UNIT - V

Reproductive System: Introduction Male reproductive system - physiological anatomy, spermatogenesis and its regulation, testicular hormones, composition of semen Female reproductive system - menstrual cycle, pregnancy and parturition, lactation and family planning. **Urinary System:** Different organs and Functions of Urinary System. Mechanism of urine formation and composition of urine.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Manipal Manual of Anatomy, 3rd Edition. Sampath Madhyastha, (2016) CBS Publishers and Distributors Pvt Ltd. Chennai.
2. Handbook of Human anatomy 3rd Edition. Chaurasia, B.D, (2005). CBS Publishers and Distributors Pvt Ltd. Chennai.
3. Human physiology, 2nd edition- BJ Mejer, HS Meij, AC Meyer, AITBs publishers abd distributers.

Reference Books

1. Text book of Anatomy. Srivastava, (2013). Books and Allied (P) Ltd, Kolkatha.
2. Anatomy and physiology in Health and illness. Cathleen JW Wilson OBE Anne Wangh. Churchill Livingstone Publication, UK, NK, 1996.
3. A Ross and Wilson's Anatomy and Physiology in Health and Illness, 9th Edition. Waugh A., Grant. Churchill Livingston, London.2001.
4. Guyton. Human Physiology and Mechanisms of Disease. Guyton AC and Hall JE. 1996. Hartcourt Publishers, Limited.
5. Gray's Anatomy. Williams PL (Ed). Churchill Livingstone, London.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: V Paper type: Elective

Paper code: Name of the Paper: C. CELL BIOLOGY

Credit: 3
Total Hours per Week: 3 Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To study the structure and function of the different cell types

Course Out Comes

1. After studying unit-1, the student will be able to understand the structures and purposes of basic components of prokaryotic and eukaryotic cells

2. After studying unit-2, the student will be able to explain how the cellular components are used to generate and utilize energy in cells

3. After studying unit-3, the student will be able to understand the cellular components underlying mitotic cell division

4. After studying unit-4, the student will be able to summarize the structure and function of the different cell components

5. After studying unit-5, the student will be able to outline how cell ultra structure is related to cell function

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I
INTRODUCTION TO CELL BIOLOGY - origin and evolution of cells, Diversity of cell size and shape Cell theory, cell as basic unit of life. Structure and organization of prokaryotic and eukaryotic cells. Comparison between plant and animal cells, General structure of cytoskeleton - structure, composition and functions of microfilaments , microtubules and intranuclear filaments.

UNIT - II

SUBCELLULAR ORGANELLES - The ultrastructure of cell wall, plasma membrane, nucleus, mitochondria, rough and smooth endoplasmic reticulum, Golgi apparatus structure and function lysosome structure and function, peroxisome, ribosomes, chloroplast and glyoxisome and their function. Organization of cells into tissue. Types of tissue. Cell - cell adhesion, cell matrix adhesion. Extracellular matrix- components and their biological role.

UNIT - III

BIOMEMBRANE - plasma structure, organization and basic functions, fluid mosaic model of structure, membrane proteins and their properties, membrane carbohydrates and their role. Transport across cell membrane - uniport, symport and antiport. Passive and active transport and water channel. Organization of cells into tissue. Types of tissue. Cell - cell adhesion, cell matrix adhesion. Extracellular matrix- components and their biological role.

UNIT - IV

ORGANIZATION OF GENOME - Organisation of prokaryotic, eukaryotic genome and chromosomes, types, structure and function. Cell division, mitosis, meiosis, their significance; Cell cycle - phases of cell cycle, comparison of mitosis and meiosis cell growth, kinetics of cell growth;

UNIT - V

CELL SIGNALING - Cell - to - Cell Signaling; Hormones and Receptors, Intracellular signaling in Development and Disease, Transport across Cell Membranes Protein Sorting: Organelle Biogenesis and Protein secretion, Stem Cell Biology, Cancer, Regulation of Cell Death; Apoptosis Circadian Rhythms.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Cell and Molecular Biology: Concepts and Experiments (6th ed). Karp, G. (2010). John Wiley & Sons. Inc.
2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology (14th ed). P.S.Verma and V.K.Agarwal. (2004). S. Chand and Company Ltd.
3. Essential Cell Biology (4th ed). Bruce Alberts and Dennis Bray (2013). Garland Science.

Reference Books

1. Cell and Molecular Biology.(8th ed). De Robertis, E.D.P. and De Robertis, E.M.F. (2010). Lippincott Williams and Wilkins, Philadelphia.
2. The Cell: A Molecular Approach. (5th ed). Cooper, G.M. and Hausman, R.E. (2009). Sunderland, Mass. Sinauer Associates, Inc.
3. The World of the Cell. (7th ed). Wayne M. Baker (2008). Pearson Benjamin Cummings Publishing, San Francisco.
4. Molecular Cell Biology 5th Edition. Harvey Lodish, Arnold Berk, Paul Matsudaira, Chris Kaiser, Monty Krieger, Matthew Scott, Lawrence Zipursky and James Darnell. W.H Freeman and Company.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Core

Paper code: Name of the Paper: MEDICAL VIROLOGY AND PARASITOLOGY

Credit: 6

Total Hours per Week: 6 Lecture Hours: 90 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To provide an in depth knowledge on diseases caused by viruses and parasites, their epidemiology and control measures

Course Out Comes

1. After studying unit-1, the student will be able to Explain the properties, classification and cultivation of viruses

2. After studying unit-2, the student will be able to Outline the zoonotic and arthropod borne diseases

3. After studying unit-3, the student will be able to Discuss about the oncogenic viruses

4. After studying unit-4, the student will be able to Describe the classification of parasites and demonstrate the laboratory diagnosis of parasitic diseases

5. After studying unit-5, the student will be able to Compile the information on common parasites, protozoan and metazoan diseases

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

General properties of virus - Classification; Structure and properties of viroids, prions; Detection of viruses and antigens in clinical specimens - Serological diagnosis of virus infections, cultivation of viruses.

UNIT - II

Arthropod borne virus (Chickungunya virus, Dengue, Japanese Encephalitis, West Nile fever, Yellow fever) and rodent borne viral diseases (Lassa, Hanta and Ebola virus) - Picorna viruses (Polio, Rhino Virus) , Hepatitis viruses (Type A, B and C) , Rabies virus, Orthomyxo (H1N1 Influenza) and Paramyxo viruses (Measles, Mumps) - SARS and MERS.

UNIT - III

Pox viruses, Adeno viruses, Herpes Simplex virus, Reo virus, Rota virus and Human immunodeficiency virus - Oncogenic virus (Papilloma virus and Polyoma virus) - Antiviral drugs, Interferon, Viral vaccines.

UNIT - IV

Introduction to Medical Parasitology - Classification of parasites - Laboratory diagnosis of common parasitic diseases. Common protozoan diseases - Amoebiasis, Giardiasis, Trypanosomiasis, Malaria, Toxoplasmosis, Leishmaniasis.

UNIT - V

Morphology of common metazoans - Pathogenicity, clinical manifestation and diagnosis of Ascariasis, Hook worm infection, Filariasis, Hydatidosis, Fasciolopsis, Schistosomiasis and Taenia infection.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Text Book of Microbiology, 9th edition. Ananthanarayan R & Paniker C.K.J. (2013). Universities Press, Hyderabad.
2. Introduction to modern virology 4th edition. Dimmok N.J and Primrose S.B (1994). Blackwell scientific company publications, United States.
3. Text book of Medical Parasitology. 4th edition. Subhash Chandra Parija (2013). All India Publishers and Distributors (Medical Books Publishers), New Delhi.

Reference books

1. Medical Microbiology. 26th edition. Jawetz, Melnick & Adelberg (2013). McGraw-Hill. New York.
2. Parasitology, Protozoology & Helminthology. 13th edition. Chatterjee K.D (2016). Joe media Publishers. Calcutta.
3. General virology. 3rd edition. Luria S.E, Darnell J.E, Baltimore D and Compare A (1978). John Wiley and Sons, New York.
4. Text book of Medical Parasitology. 5th edition. Jayaram Paniker C.K (2004). Jaypee Brothers Publishers (P) Ltd., New Delhi.
5. Medical Parasitology. Revised edition. Karyakarte R.P and Damle AS (2005). Books and Allied (P) Ltd., Kolkata.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Core

Paper code: Name of the Paper: INDUSTRIAL MICROBIOLOGY

Credit: 5
Total Hours per Week: 5 Lecture Hours: 75 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To familiarize the learners on the basic microbial processes carried out in Industries and its significance

Course Out Comes

1. After studying unit-1, the student will be able to Outline the history and scope of Industrial Microbiology

2. After studying unit-2, the student will be able to Explain about the methods involved in screening and development of production strains

3. After studying unit-3, the student will be able to Elaborate on the principles, design and types of bioreactors

4. After studying unit-4, the student will be able to Compile on the fermentation process and downstream processing

5. After studying unit-5, the student will be able to Discuss on the industrial production of various products using microorganisms

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

General concept of Industrial Microbiology; History and scope of Industrial Microbiology; Industrially important Microorganisms and their products; screening and strain development strategies; Preservation techniques of the production strains.

UNIT - II

Bioreactor - Principle, Design, mode of operation and types; Fermentation- types of fermentation process (Batch and Continuous fermentation); Fermentation media, Sterilization of media; Down Stream processing.

UNIT - III

Foods produced by Microbes - Fermented foods - Bread, Pickles; Fermented Beverages - Beer and Wine; Dairy products - Yoghurt, Cheese; Microbial cell as food - Single Cell Proteins.

UNIT - IV

Microbial production of Organic acids - Citric acid, Lactic acid, Acetic acid; Amino acid production - glutamic acid and lysine; Steroid transformations

UNIT - V

Production of enzymes - Amylase, Protease; Ethanol production; Antibiotics - Penicillin, Streptomycin; Vitamin - B12.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Industrial Microbiology. 3rd edition. Patel A.H (2001). Mac Millan India ltd, New Delhi.
2. Industrial Microbiology. 2nd edition. Casida J.E (2005). Wiley Blackwell publishers, UK.
3. Pharmaceutical Microbiology. 4th edition. Hugo W.B and Russell A.D (2002). Blackwell scientific publications / oxford, London

Reference books

1. Principles of Fermentation technology. 1st edition. Stanbury P.F., Whitaker A and Hall S.J (1995). Pergamon, UK.
2. Principles and Applications of Fermentation Technology. 1st edition. Arindam Kuila & Vinay Sharma (2018). Scrivener Publishing LLC, Beverly.
3. Industrial Microbiology: An Introduction. 1st edition. Michael J. Waites, Neil L. Morgan, John S. Rockey, Gary Higton (2001). Blackwell publishers, USA
4. Industrial Microbiology. 1stedition. Prescott and Dunn (1982). AVI Publishing co., west port, Connecticut, USA.
5. The Complete Book of Tanning Skins & Furs. 1st edition. James Churchill (1983). Stackpole Books, UK.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	M	S
CO2	M	S	M	S	M	S	S	S	S	M

CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	M	M	M	M	S
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Practical

Paper code: Name of the Paper: EXPERIMENTS IN MEDICAL MICROBIOLOGY

Credit: 3

Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours:45

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Course Objectives

1. To process clinical specimens
2. To observe pathogenic microorganisms in specimens by microscopy
3. To isolate pathogenic bacteria from clinical specimens
4. To identify pathogenic bacteria from clinical specimens
5. To find out the antibiotic susceptibility pattern of pathogenic bacteria

Course Out Comes

After completing the course, the student will be able to

1. observe pathogenic microorganisms in specimens by microscopy
2. isolate pathogenic bacteria from clinical specimens
3. identify pathogenic bacteria from clinical specimens
4. characterize pathogenic bacteria isolated from clinical specimens
5. find out the antibiotic susceptibility pattern of pathogenic bacteria

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

LIST OF EXPERIMENTS

Acid fast staining for *M. tuberculosis*

LPCB mounting of fungal pathogens

Examination of stool samples for parasites

Type study of the following bacteria - *Staphylococcus aureus*, *Streptococcus pyogenes*, *Escherichia coli*, *Klebsiella* sp., *Salmonella* sp., *Shigella* sp., *Proteus* sp., *Pseudomonas aeruginosa*.

Coagulase test for Staphylococci

Isolation of pathogenic bacteria from sputum

Isolation of pathogenic bacteria from urine

Isolation of pathogenic bacteria from faeces

Blood culture

Antibiotic susceptibility test

Internal Assessment Methods:

- Regularity in lab course
- Performance assessment in each eaxperiment
- Viva voce
- Submission of Observation report
- Model practical exam

Reference Manuals

1. Monica Cheesbrough. District Laboratory Practice in Tropical Countries - Part I and II 2nd edition. Cambridge University Press, New Delhi. 2006.

2. Mackie and McCartney. Practical Medical Microbiology, South Asia Edition. 14th edition. 2006.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	M	S	M	S
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	M	S	S	S	S
CO4	S	S	S	S	M	S	M	M	M	S

CO5	S	S	M	S	M	M	S	M	S	S

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Practical

Paper code: Name of the Paper: EXPERIMENTS IN APPLIED MICROBIOLOGY

Credit: 3
Total Hours per Week: 3 Lecture Hours: Nil Tutorial Hours: Nil Practical Hours: 45

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Course Objectives

1. To observe microorganisms in spoiled food and vegetables
2. To enumerate the microorganisms in air
3. To enumerate the microorganisms in water
4. To enumerate the microorganisms in soil
5. To demonstrate the presence of *Rhizobium* in root nodules

Course Out Comes

After completing the course, the student will be able to

1. observe microorganisms in spoiled food and vegetables
2. enumerate the microorganisms in air, water and soil
3. enumerate the coliforms in water
4. demonstrate the production of enzymes by bacteria
5. demonstrate the presence of *Rhizobium* in root nodules

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

LIST OF EXPERIMENTS

Microscopic observation of curd

Microscopic observation of spoiled food and vegetables

Methylene Blue Reduction test

Enumeration of microorganisms from air by Open plate method

Enumeration of bacteria from water sample

Enumeration of bacteria and fungi from soil sample

Test for coliforms in water by MPN method

Test for coliforms in water by Presence - Absence method

Demonstration of amylase producing bacteria

Demonstration of lipase producing bacteria

Demonstration of protease producing bacteria

Cross section of root nodules

Isolation of *Rhizobium* from root nodules

Internal Assessment Methods:

- Regularity in lab course
- Performance assessment in each eaxperiment
- Viva voce
- Submission of Observation report
- Model practical exam

Reference Manuals

1. Rajan. S and Selvi Christy (2015). Experimental Procedures in Life Sciences, Anjanaa Book House Publishers, Chennai.

2. Cappuccino and Sherman. Microbiology: A Laboratory manual by (7^{th} edition) Berjamin Cummings Publications, 2004.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Elective

Paper code: Name of the Paper: A. BIOTECHNOLOGY

Credit: 3
Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To learn the various applications of living organisms and their products from the economic perspective

Course Out Comes

1. After studying unit-1, the student will be able to understand basic concepts of Biotechnology

2. After studying unit-2, the student will be able to demonstrate the uses of enzymes

3. After studying unit-3, the student will be able to express the importance of plant biotechnology

4. After studying unit-4, the student will be able to explain the role of animal biotechnology

5. After studying unit-5, the student will be able to discuss the role of microorganisms in environment

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Concept of Biotechnology - Definition and history of Biotechnology - Major areas of Biotechnology - Indian scenario in Biotechnology - centers, activities achievements and bio-industries in India.

UNIT - II

Enzyme technology - Enzyme immobilisation, Products, Applications - Biotechnological potentials of Seaweeds, Microalgae - Biofuel - Hydrogen gas as fuel from Microorganisms - Biosensors-different types, applications - medical and non medical

UNIT - III

Genetic engineering of plants - Electroporation - Gene gun - Particle bombardment - Ti plasmid vectors - Applications - Transgenic plants - Insect resistant, Stress tolerant, Virus resistant plants, genetically modified foods - Terminator gene technology - concept and basics

UNIT - IV

Transgenic animals - Retroviral vector method, DNA micro injection method - Applications of rDNA technology - Recombinant products - insulin, tPA, vaccines - Gene therapy - Patents - IPR

UNIT - V

Bioremediation - Clean-up Biotechnology - Microbial removal of metal ions - Soil Bioremediation - Removal of oil spill - Biodegradation of hydrocarbons - Genetically modified organisms.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Biotechnology. Singh B.D. 2006. Kalyani Publishers, New Delhi.
2. Genetics - A Molecular approach. 3rd edition. Brown J.A. 2001. Nelson Tornes.

Reference books

1. Text Book of Biotechnology. Pandian, T.T. and Kandavel, D.2008. I.K International Publishing House, New Delhi.
2. Essentials of Biotechnology. Ane Books Pvt. Ltd. New Delhi.
3. Text book of Biotechnology. Das, H.K. 2007. Wiley India Pvt. Ltd. New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Elective

Paper code: Name of the Paper: B. HERBAL TECHNOLOGY

Credit: 3

Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To identify and exploit the potential benefits of plants for the betterment of human life

Course Out Comes

1. After studying unit-1, the student will be able to get acquainted with the basics of Pharmacognosy

2. After studying unit-2, the student will be able to Gain knowledge of medicinal plants

3. After studying unit-3, the student will be able to Understand the use of various medicinal plants

4. After studying unit-4, the student will be able to Appreciate the Herbal medicines used to treat human ailments

5. After studying unit-5, the student will be able to Understand the Propagation methods of medicinal plants

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Pharmacognosy: Pharmacology - Definition and history; Indian systems of medicine - Siddha, ayurvedha, and Unani systems; Classification of Crude drugs; Chemistry of Drugs; Future of pharmacognosy.

UNIT - II

Classification of medicinal plants; locally available medicinal plants - Vernacular name and family - Geographical Distribution; Crude drugs - chemical composition - pharmaceutical uses - processing and marketing.

UNIT - III

Medicinal plant parts as herbal medicines: Leaves - Adathoda, Eucalyptus; Flower - Clove; fruits seeds - Nux vomica Nutmegs, Gooseberry - unorganized drugs; Gum - Acacia - Resin - Turpentine, fixed oil - castor oil. Underground stem - ginger, Alpinia; Roots - Rauolfia, Belladona; Aerial parts - Bark - Cinchona.

UNIT - IV

Herbal medicines for Human ailments - Drugs acting on Blood pressure, cardiac diseases, cerebral diseases, Respiratory diseases - Drugs acting on Nervous system - Depressants. - stimulants - Urogenital system - Psychoactive plants; Drug adulteration - methods of Drug evaluation.

UNIT - V

Propagation of medicinal plants - cultivation of medicinal and aromatic plants - Micro and macro propagation - conservation of rare medicinal plants - seed banks - Role of biotechnology in medicinal plants - Herbal food - Food processing - packaging - Herbal sale and Export of medicinal plants - marketing - Intellectual property rights - Export laws.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Herbal Drug Technology, 2nd Edition. Agarwal, S.S and Paridhavi, M (2012). Universities Press (India) Private Ltd.
2. Herbal Plants and their Applications in Cosmeceuticals. Kuntal Das (2014). CBS publishers and distributors Pvt. Ltd., Chennai.

Reference books

1. Pharmacognosy 12th edition. George Edward Trease and W.C. Evans. English Language Books Society, Baelliere Tindall.
2. Pharamcognosy by 2nd Edition. Handa, S.S. and Kapoor, V.K. Vallabh Prakashan Publishers, New Delhi.
3. Indian Medicinal plants. Jain, S.K (1980).
4. Pharmacognosy by 12th edition. Kokate, C.K., Durohit, A.P. and Gokhale, S.R. Nirali Prakasham Publishers, Pune.
5. Introduction to Medical Botany and Pharmacognosy. Kumar N.C. (1993).

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	M	M	M	S	M	S	M	S
CO2	M	S	S	S	M	S	S	S	S	M

CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	M	S	S	M
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Elective

Paper code: Name of the Paper: C. GENETIC ENGINEERING

Credit: 3

Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To introduce the concept of recombinant DNA technology for the development of products of biological origin

Course Out Comes

1. After studying unit-1, the student will be able to Get acquainted with the basics of Genetic Engineering
2. After studying unit-2, the student will be able to Understand the role of various enzymes acting on DNA
3. After studying unit-3, the student will be able to Gain knowledge of Cloning vectors
4. After studying unit-4, the student will be able to Understand the Gene / DNA transfer techniques
5. After studying unit-5, the student will be able to Appreciate the applications of rDNA technology

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Milestones in Genetic Engineering - Definition of gene manipulation - Major steps involved in gene cloning - Isolation and Purification of Chromosomal and Plasmid DNA, Isolation and Purification of RNA - Chemical Synthesis of DNA, Genomic Library and cDNA Library - applications.

UNIT - II

Restriction endonucleases: Discovery, Type I, II and III and Mode of action, Applications of type II restriction endonucleases, Ligases, DNA polymerases, DNA modifying enzymes and topoisomerases.

UNIT - III

Cloning vectors: Definition and properties - Plasmid based vectors: Natural vectors (pSC101, pSF2124, pMB1), Artificial vectors (pBR322 and pUC) - Phage based vectors - Lamda) phage vectors and its derivatives - Hybrid Vectors; Phagemid and Cosmid, BAC and YAC - Expression systems - *E. coli*.

UNIT - IV

Gene/ DNA transfer techniques: Physical - Biolistic Method (Gene gun), Chemical- Calcium chloride and DEAE Methods, Biological in vitro packaging method in viruses - Selection and Screening of recombinants: Direct Method: Selection by Complementation, Marker inactivation methods - Indirect methods: Immunological and Genetic methods.

UNIT - V

Blotting (Southern, Western, Northern and North- eastern) techniques - PCR - basic steps in DNA amplification, RAPD, RFLP and their applications - DNA finger printing - DNA microarray analysis - Applications of recombinant DNA technology.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. An introduction to Gene Cloning, 3rd edition. Brown TA. 1995. Champman and Hall.
2. Gene Cloning and DNA Analysis, 7th edition. Brown TA. 2015. Wiley Blackwell.
3. Principles of Gene Manipulation and Genomics. Primrose SB and Twyman RM. 2006. Wiley Blackwell, 7th edition.

Reference Books

1. Principle of Gene Manipulation, 5th edition. Old RW and Primrose SB. 1995. Blackwell Scientific Publication, Boston.
2. Gene Cloning - Principles and Applications. Julia Lodge, Peter Lund and Steve Minchin. 2006. Taylor and Francis, UK.
3. From gene to clones, Introduction to Gene Technology. Winnecker ED. 1987. VCH Publication, FRG.
4. Molecular Biotechnology. Principles and Application of recombinant DNA, Glick BR and Pasternak JJ. 1994. ASM Press. Washington.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	M	S	M	S	M	S
CO2	M	S	M	S	S	S	M	S	S	S

CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	S	M	S	S	M
CO5	S	S	S	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Elective

Paper code: Name of the Paper: A. BIOINOCULANTS TECHNOLOGY
Credit: 3
Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To identify, characterize and make use of Plant Growth Promoting Rhizobacteria for increased production in agriculture

Course Out Comes

1. After studying unit-1, the student will be able to Understand the role of Plant Growth Promoting Rhizobacteria
2. After studying unit-2, the student will be able to Get acquainted with production and field application of *Rhizobium* and *Frankia*
3. After studying unit-3, the student will be able to Gain knowledge of Cyanobacteria as N_2 fixers
4. After studying unit-4, the student will be able to Understand the Phosphate solubilizing microbes
5. After studying unit-5, the student will be able to Appreciate the role of Mycorrhiza in plant growth promotion

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Biofertilizers, Plant Growth Promoting Rhizobacteria; Bioinoculants; General account of the microbes used as biofertilizers for crop plants and their advantages. Non - Symbiotic N_2 fixers - *Azospirillum* - *Azotobacter* - Taxonomic characters, isolation, characterization, mass production and field application.

UNIT - II

Symbiotic N_2 fixers: *Rhizobium* - Isolation, characterization, identification, Classification, inoculum production and field application. *Frankia* - Isolation, characterization - actinorrhizal nodules - non-leguminous crop symbiosis.

UNIT - III

Symbiotic N_2 fixers - Cyanobacteria, *Azolla* - *Anabaena* - Isolation, characterization, mass multiplication - Role in rice cultivation - Crop response - field application - immobilization.

UNIT - IV

Phosphate solubilizers - Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field application - Phosphate solubilization mechanism.

UNIT - V

Mycorrhizal bioinoculants - Taxonomy of mycorrhizae - importance of mycorrizal Ectomycorzhizae - Endomycorrhizae - Ectendo mycorrhizae - Isolation of VA mycorrhizae - Quantification and assessment of VAM in roots - Mass inoculum production of VAM - field applications of Ectomycorrhizae and VAM.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Bioetchnology of Biofertilizers. Kannaiyan, S. (2003). CHIPS, Texas.
2. Hand book of Microbial biofertilizers. Mahendra K. Rai (2005). The Haworth Press, Inc. New York.
3. Bioinoculants for sustainable agriculture and forestry. Reddy, S.M. et. al. (2002). Scientific Publishers.

Reference Books

1. Soil microorganisms and plant growth. Subba Rao N.S (1995) Oxford and IBH publishing co. Pvt. Ltd. New Delhi.
2. Biofertilizers in Agriculture and forestry. Subba Rao N.S. (1988) Oxford and IBH Publishing Co., Ltd., New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

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

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Elective

Paper code: Name of the Paper: B. CLINICAL MICROBIOLOGY

Credit: 3
Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To familiarize students on clinical laboratory guidelines, infections of organs and organ systems, transmission and detection of diseases.

Course Out Comes

1. After studying unit-1, the student will be able to Collect various clinical specimens for microbiological examination.
2. After studying unit-2, the student will be able to Gain knowledge on infections of different organ and organ system
3. After studying unit-3, the student will be able to Comprehend the different modes of transmission of infection, prevention and its control
4. After studying unit-4, the student will be able to outline the importance of immunoprophylaxis, genetic disorders and gene therapy
5. After studying unit-5, the student will be able to Perform laboratory tests to detect infection and diseases

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Philosophy and General Approaches to clinical specimens - clinical laboratory standard guidelines - Collection and transportation of specimens for microbiological examination (Pus, Urine, blood, CSF, body fluids etc.). Collection of data and maintenance of laboratory records.

UNIT - II

Normal microbial flora of human body .Infection and infectious diseases- types of infection. Pathogenic/parasitic organisms: Bacterial, viral and protozoan infections of the gastrointestinal

system, nervous system, lung, liver and eye- Transmission and spread of diseases - Disease epidemiology.

UNIT - III

Sexually transmitted diseases, arthropod borne diseases, skin infections and zoonosis. Control and prevention of infections - drugs and antibiotics - drug resistance; Immunodeficiency, Autoimmunity and hypersensitivity.

UNIT - IV

Blood parasites (Malaria, Filaria) - importance, lifecycle, spread and Control of vectors - Mosquito control. Laboratory control of antimicrobial therapy, Immunoprophylaxis. Vaccines - types and methods of action. Genetic disorders and Gene therapy.

UNIT - V

Biochemical changes due to different infections - Blood tests - blood smear preparation - thick and thin - Leishman and Giemsa staining ; tissue analysis. Isolation and identification of organisms from tissue samples. Disease detection - conventional and molecular techniques.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Diagnostic Microbiology, 13th Edition. Bailey and Scott, (2013). Elsevier Health Sciences publishers.
2. Mackie, Mc Cartney's Practical Medical Microbiology,14th Edition. Collee, J.C. Dugrid, J.P., A.C., Marimion, B.P (2007). Churchill Livingstone.
3. Medical Microbiology. 14th edition. David Greenwood, Richard CD, Slack, John Forrest Peutherer. (2010). ELBS with Churchill Livingstone.

Reference Books

1. Essential Immunology. Ivan M. Roit. (2010). Wiley India Pvt. Ltd, New Delhi.
2. Topley & Wilsons's. (1990) Principles of Bacteriology, Virology and Immunity, VIII edition, Vol. III Bacterial Diseases, Edward Arnold, London.
3. Medical Microbiology. 26th edition. Jawetz, Melnick, & Adelberg's. (2013). McGraw-Hill, New York.
4. Text book of Medical Parasitology. 4th edition. Subhash Chandra Parija (2013). All India Publishers and Distributors (Medical Books Publishers), New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	M	S

CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	S	S
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Elective

Paper code: Name of the Paper: C. FOOD ANALYSIS AND QUALITY CONTROL

Credit: 3

Total Hours per Week: 3 Lecture Hours: 45 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

The paper focuses on analysis of food, concepts of quality control and quality management

Course Out Comes

1. After studying unit-1, the student will be able to Understand the Techniques used in food analysis
2. After studying unit-2, the student will be able to Get acquainted with various food analysis methods
3. After studying unit-3, the student will be able to Gain knowledge on the various methods of food quality assessment
4. After studying unit-4, the student will be able to Understand the Food quality management procedures
5. After studying unit-5, the student will be able to Appreciate the role of Food Safety organizations

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Sampling - Sampling techniques and preparation of food samples. **Techniques used in food analysis -** Chromatography, Electrophoresis, Electrometric determinations, Refractometry and Polarimetry Spectrophotometry, Fluorimetry, Radio - active tracer techniques, Atomic absorption

UNIT - II

Physico chemical methods for food analysis - Moisture and Total solids, Carbohydrates, Proteins, Fats, Fiber, Ash and its types, Minerals, Vitamins. Enzymatic methods **Biological methods of food analysis -** Standard plate count; Plate loop method; Spiral plate; Droplet

technique; Dye reduction; Catalase test and ELISA. Testing of food for organisms such as *B. cereus, C. botulinum, E. coli*, *L. monocytogenes, S.aureus, Salmonella* and *Shigella.*

UNIT - III

Sensory assessment of food quality - Appearance of food, Flavor of food, Texture of food. **Sensory Tests -** Difference, Rating and Sensitivity tests. Types of panels, Testing area and schedule. **Quality control of following food products -** Milk and milk products, Oils and Fats, Cereal grains and flours, Fruits and vegetable products, Canned foods, Egg and egg products, Meat and Meat products

UNIT - IV

Food quality management - Objectives, Importance and Functions of quality control. Total quality, management, Good manufacturing practices, seven principles of HACCP and codex in food. Quality control, methods of - a. raw materials, b. manufacturing process and c. finished products.

UNIT - V

Food Safety - Role of voluntary agencies and legal aspects of consumer protection. National and International food laws - PFA, FDA, BIS, AGMARK, Essential Commodity Act, Export (quality and inspection act, Consumer protection act), Nutritional labeling requirements of foods, Food adulteration.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Food Analysis - Theory & Practice. Pomeranz.Y, Meloan.C.E, 1996. CBS Publiushers, New Delhi.
2. Food microbiology, 4th edition. Frazier, W.C and Westhoff, D.C (1988). Tata Mac Graw Hill, New Delhi.

Reference books

1. Chemical Analysis of Food & Food Products. Jacobs.M.B., 1999. CBS Publiishers, New Delhi.
2. Introduction to chemical Analysis of foods. Nielsen, S.S, 2004. CBS Publishers, New Delhi.
3. Handbook of Analysis & Quality control for Fruit & Vegetable Products. Ranganna. S., 2001. Tata McGraw Hill, New Delhi.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	S	M	S	M	S	M	S

CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	S	S	M	S	S	S	S	S	S
CO4	S	S	S	S	M	S	M	S	S	S
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

Semester: VI Paper type: Skill-based subject

Paper code: Name of the Paper: MEDICAL LABORATORY TECHNIQUES

Credit: 2

Total Hours per Week: 2 Lecture Hours: 30 Tutorial Hours: Nil Practical Hours: Nil

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Course Objectives

To provide students an effective background on Medical Laboratory techniques.

Course Out Comes

1. After studying unit-1, the student will be able to Outline the general laboratory procedures for collection of various specimens
2. After studying unit-2, the student will be able to Explain the mechanism of coagulation and procedures carried out in estimation of blood cells
3. After studying unit-3, the student will be able to Describe about chemical and microbiological examination of CSF, Urine, semen, stool and vaginal fluids
4. After studying unit-4, the student will be able to Elaborate on the collection and testing of amniotic fluid, gastric juice, lymph, sputum and synovial fluid
5. After studying unit-5, the student will be able to Apply the theoretical knowledge in practice

Matching Table

Unit	i. Remembering	ii. Understanding	iii. Applying	iv. Analyzing	v. Evaluating	vi. Creating
1	Yes	Yes	Yes	Yes	No	No
2	Yes	Yes	Yes	Yes	No	No
3	Yes	Yes	Yes	Yes	No	No
4	Yes	Yes	Yes	Yes	No	No
5	Yes	Yes	Yes	Yes	No	No

UNIT - I

Medical laboratory practices; General Laboratory apparatus, procedures, glassware's, safety measures, first aid in lab- sterilization and disinfection procedures. Blood- components of blood (plasma and cellular elements) and their functions.

UNIT - II

Hematopoietic system of the body (Erythropoiesis, Leucopoiesis and Thrombopoeisis)- Abnormalities in blood cell morphology - types of Anaemia and Leukemia. Blood grouping, Blood bank, Blood transfusion (Coomb's test, cross matching).

UNIT - III

Coagulation system: Clotting time, bleeding time. Estimation of PCV, ESR, RBC count, WBC count, Differential count, Platelet count. Mechanism of coagulation and Platelet disorders.

UNIT - IV

Body fluids- Physical properties, compartments, solutes and movements. CSF- physical examination, functions of CSF, chemical analysis, microbiological examination. Urine analysis, semen analysis, stool and vaginal fluid analysis and Pap smear.

UNIT - V

Amniotic fluid- chemical composition, functions and collection. Testing -Alpha-fetoproteins, Acetylcholisnesterase, Neural tube defects. Collection of lymph, gastric juice, sputum, synovial fluid and testing.

Internal Assessment Methods:

Course teachers can choose one or more of the following innovative methods: Book review, Data collection, Workshops, Preparing question paper by the candidates, Assignments, Open book examination, Field study, Group discussion, Oral presentation / Seminar, Slip tests.

Text Books

1. Textbook of Medical Laboratory Technology. 1st edition. Mrinalini Sant M D. (2020). CBS Publishers& Distributors.
2. Textbook of Medical Laboratory Technology. 1st edition. Praful B. Godkar and Darshan P. Godkar. (2014). Bhalani Publishing House.
3. District Laboratory Practice in Tropical Countries - Part I and II. 2nd edition. Monica Cheesbrough. (2005). Cambridge University Press, New Delhi.

Reference books

1. A Concise note on Medical Laboratory Technology. Maiti. C.R. (2002). New central book agency. New Delhi
2. Basic Clinical Laboratory Techniques. 6th edition. Barbara H. Estridge and Anna P. Reynolds (2011). Cengage learning publishers, United States
3. Concise Book of Medical Laboratory Technology Methods and Interpretations. 2nd edition. Ramnik Sood. (2015). Jaypee Health Science publishers.
4. Laboratory Procedures in Haematology, 1st edition. Mehdi S.R (2006). Jaypee Publishers.

Course Material: website links, e-Books and e-journals

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	S	M	S	M	S	S	M	S	M	S
CO2	M	S	M	S	M	S	M	S	S	M
CO3	S	M	S	M	S	S	S	S	S	S

CO4	S	S	S	S	M	S	M	S	S	S
CO5	S	S	M	S	M	S	S	M	S	M

PO – Programme Outcome, CO – Course outcome

S – Strong , M – Medium, L – Low

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QUESTION PAPER PATTERN (Practical)

Internal Examination - Maximum = 25 Marks
External Examination - Maximum = 75 Marks
Total - Maximum = 100 Marks

External Examination - Maximum 75 Marks
(Will be conducted on two consecutive days of three hours each)

Question	Description	Marks
1	Minor Experiment (to be reported on the same day)	**1 x 20 Marks = 20 Marks**
2	Major Experiment (to be reported on the second day)	**1 x 30 Marks = 30 Marks**
3	Spotters	**5 x 3 Marks = 15 Marks**
4	Record Notebook	**10 Marks**
	Total	**75 Marks**

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