SCHEME & SYLLABUS M. Sc.-Medical Microbiology

(Choice Based Credit System)
Program Code: PG032



Department of Life Sciences and Allied Health Sciences
UIS
SANT BABA BHAG SINGH UNIVERSITY
2022

ABOUT THE DEPARTMENT

The department of Life Sciences formerly known as the Department of Natural Sciences was established in the year 2015 with only two UG programmes. Over the years this department has flourished and is offering various Programmes and courses at graduate, post-graduate and doctorate level in field of Botany, Zoology, Biotechnology, Biochemistry, Microbiology and Laboratory Sciences. The department is nurtured by the highly qualified and dedicated Faculty, honoured by various international and national awards. The department is blessed to have specialized faculties in various fields of Life Sciences viz. Plant physiology, Plant Biochemistry, Plant Microbe interaction, Stress Physiology, Chemical ecology, Microbial Physiology, Industrial Microbiology, Clinical microbiology, Microbial Biotechnology, Biotechnology, Fisheries, Parasitology, Molecular biology, Entomology, Sericulture, Animal toxicology, Endocrinology, Biochemistry and Biodiversity

SALIENT FEATURES OF THE DEPARTMENT

- Research oriented curriculum designed to enable students to acquire all the skills needed to collect and analyze the data.
- The Institute drawing upon its strength of highly qualified well trained faculty, state of art infrastructure and innovative teaching methodology.
- Elective courses that brides the gap between industry requirements and academia.
- The department is disseminating various educational missions via e-learning platform in the form of SWAYAM, Virtual lab etc.
- The department is equipped with a number of instruments and facilities like, UV-Visible Spectrophotometer, High Speed Centrifuge, Deep Freezer, Laminar Air flow, Air Samplers, Autoclave, Incubator, Photo actometer, Air condition Labs, WiFi, Library etc.
- The department has organized a large number of conferences, seminars, symposia and workshops. National and International eminent scientists of the country have been associated with the Department as visiting and honorary professors.

Medical Microbiology

Scientific and technological advancements have created complexity in the diagnostic field necessitating advanced educational preparation. To keep pace with the tremendous progress in Medical Science and to meet changing health care needs specialization and research are essential in the field of Laboratory science. The specialties are provided by the university in M. Sc. Medical Microbiology, M. Sc. Medical Laboratory Science (Clinical Microbiology).

VISION

To bridge the gap between demand and supply for Life Science and Allied Health Professionals with grooming young generations along with their moral and spiritual development.

MISSION

To radiate the knowledge of Life Science and Allied Health Science through quality education by using latest technology, modern infrastructure and the framework needed for the development of professionals.

ELIGIBILITY CRITERIA

B.Sc. MLT/MLS/ Applied Medical Science/ Bio- Science/ Medical Science/ Allied Medical Science/ Life Science/Microbiology/Biochemistry/ Biotechnology.

DURATION

2 Years

CAREER PATHWAYS

The program is designed to meet the growing requirement of qualified professionals in field of Healthcare industry and education: The Medical Microbiologists/ technician may be assigned to a specialized area of work in a large medical labs/ research labs/ Intermediate reference labs. They can also work as laboratory manager/ consultant/ supervisor, health care administrator, hospital outreach coordinator, laboratory information system analyst/ consultant, educational consultant/coordinator/ director, health and safety officers.

PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

- **PEO1.** To educate graduates in basic and advanced areas of Medical microbiology and other related subjects along with sensitizing them to the scope for research.
- **PEO2.** To empower the students with analytical and research skills.
- **PEO3.** To foster entrepreneurial endeavors and to prepare a competent generation of microbiologist.
- **PEO4.**To develop microbiologists with skills to pursue careers both in academia as well as in industry.

PROGRAMME OUTCOMES (PO)

- **PO1. Disciplinary Knowledge**: The student has acquired in-depth knowledge of the various theoretical and practical concepts regarding the role of microbial infection in human health and its immune response.
- **PO2.** Critical Thinking: Critical thinking as an attribute enables a student to identify, formulate and apply knowledge to develop critical thinking and practical understanding in the field of microbiology to find solutions for human benefits.
- PO3. Problem Solving: gain hands on experience in state-of-the-art laboratory equipment that could enrich them to perform high through put research on microorganisms and execute diagnostic procedures in field of medical microbiology
- **PO4. Scientific /Analytical Reasoning:** Students learn to investigate, experiments/ theoretical methods, relate information and interpretation of data based on scientific reasoning. The student will be able to draw logical conclusions based on a group of observations, mathematical techniques and measurements
- **PO5. Multicultural Competence:** The ability to understand and consecutively relate to uniqueness of each student in light of diverse culture that influence in multi prospective
- **PO6.** Environment & Sustainability: Student's ability to understand overall goal of conserving natural resources and create and develop energy efficient projects and practice.
- **PO7. Research related skills & Ethics:** develop the skill to think independently, plan research and execute it in different fields of Microbiology. The student is aware of what constitutes unethical behavior-- fabrication, plagiarism and misrepresentation or manipulation of data

PO8. Individual and Team Work: acquire the ability to function effectively on teams to accomplish a common goal. The student is capable of contributing meaningfully to team ethos and goals.

PO9. Communication Skills: Students are encouraged to communicate scientific concepts, experimental results and analytical arguments clearly and concisely, both verbally and in writing.

PO10. Lifelong Learning: students opt for higher studies, jobs in various sectors and entrepreneurship abilities in the field of microbiology

PROGRAMME SPECIFIC OUTCOMES (PSO)

- **PSO1.** Get equipped with a theoretical and practical knowledge of Medical microbiology.
- **PSO2.** Explain about various applications of Microbiology such as Microbial Pathogenicity.
- **PSO3.** Design and execute experiments related to Basic Microbiology, Immunology, Molecular Biology, Recombinant DNA Technology, and Microbial Genetics.
- **PSO4.** Execute a short research project incorporating techniques of Basic and Advanced Microbiology under supervision.
- **PSO5.** Take up a suitable position in academia or industry, and to pursue a career in research if so desired

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Course Scheme M. Sc. Medical Microbiology (Semester-I-IV)

SEMESTER I

I. Theory Subjects

S. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
1	MMB501	Basic Medical Microbiology	4:0:0	4:0:0	4	4	CC
2	MMB505	Systematic Bacteriology	4:0:0	4:0:0	4	4	CC
3	MMB515	Molecular Biology	3:0:0	3:0:0	3	3	CC
4	MMB519	Bioana <mark>l</mark> ytical Tech <mark>niq</mark> ues	3:0:0	3:0:0	3	3	CC
5	1.11.12021	Bioethics, Biosafety & Intellectual Property Right	3:0:0	3:0:0	3	3	SECC
6	MAT515	Biostatistical Methods	3:0:0	3:0:0	3	3	ID

II. Practical Subjects

1	MMB503	Basic Medical Microbiology (Practical)	0:0:4	0:0:2	4	2	CC
2	MMB507	Systematic Bacteriology (Practical)	0:0:4	0:0:2	4	2	CC
3	MMB517	Molecular Biology (Practical)	0:0:2	0:0:1	2	1	CC
	Total					25	

Total Contact hrs: 30 Total Credit Hours: 25

SEMESTER-II

I. Theory Subjects

S. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
1	MMB502	Applied Bacteriology	3:0:0	3:0:0	3	3	CC
2	MMB506	Medical Parasitology	3:0:0	3:0:0	3	3	CC
3	MMB510	Biochemistry and Metabolism	3:0:0	3:0:0	3	3	CC
4	MMB514	Antimicrobial Agents and Chemotherapy					
5	MMB516	Laboratory Organization and Management	3:0:0	3:0:0	3	3	DSE
6	MMB518	Medical Anatomy & Physiology I			A		
7	CSE554	Introductory Concepts of Computer Technology	3:0:0	3:0:0	3	3	ID
8	EVS003	Natu <mark>ra</mark> l Hazard <mark>s&</mark> Disa <mark>st</mark> er Mana <mark>ge</mark> ment	3:0:0	3:0:0	3	3	AECC

II. Practical Subjects

1	MMB504	Applied Bacteriology (Practical)	0:0:4	0:0:2	4	2	CC
2	MMB508	Medical Parasitology (Practical)	0:0:4	0:0:2	4	2	CC
3	MMB512	Biochemistry and Metabolism (Practical)	0:0:4	0:0:2	4	2	CC
4	CSE556	Introductory Concepts of Computer Technology (Practical)	0:0:2	0:0:1	2	1	ID
Total					32	25	

Total Contact hrs: 32 Total Credit Hours: 25

SEMESTER III

I. Theory Subjects

S. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
1	MMB601	Medical Mycology	3:0:0	3:0:0	3	3	CC
2	MMB605	Medical Virology	3:0:0	3:0:0	3	3	CC
3	MMB609	Immunology	4:0:0	4:0:0	4	4	CC
4	MMB613	Recombinant DNA Technology (RDT)					
5	MMB619	Applications of Microbiology	3:0:0	3:0:0	3	3	DSE
6	MMB621	Medical Ana <mark>tomy</mark> & Physiolog <mark>y I</mark> I		20			
7	MMB623	Bioinformatics	2:0:0	2:0:0	2	2	SECC
8	MMB625	Medical Diagnostics	2.0.0	2.0.0	A	2	SLCC
9	MMB615	Res <mark>ea</mark> rch Met <mark>ho</mark> dology	2:0:0	2:0:0	2	2	AECC

II. Practical Subjects

1	MMB603	Medic <mark>al</mark> Mycolo <mark>gy</mark> (Practica <mark>l</mark>)	0:0:4	0:0:2	4	2	CC
2	MMB607	Medical Virology (Practical)	0:0:2	0:0:1	2	1	CC
3	MMB611	Immunology (Practical)	0:0:4	0:0:2	4	2	CC
4	MMB617	Seminar	0:0:2	0:0:1	2	1	AECC
Total	Total					23	

Total Contact hrs: 29

Total Credit Hours: 23

SEMESTER-IV

Dissertation/Project

S	. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours	Course Type
	1	MMB 602	Dissertation/Project	5 Months	0:0:26	512	26	CC

Contact Hours*: Submission within five months

Total Contact hrs: 512 Total Credit Hours: 26



COURSE SCHEME SUMMARY

Semester	L	Т	P	Contact hrs/wk	Credits
1	20	0	10	30	25
2	18	0	14	32	25
3	17	0	12	29	23
4	0	0	26	26	26
Total	55	SBI	62	117	99

Note: Each student will submit Project report on any topic related to Medical Microbiology. Project report will be guided by subject teachers of the University and will be examined by external Examiner.

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Total Contact hrs for I-III semester: 91 Total Credit Hours for I-III semester: 73

Total Contact hrs for IV semester: 512 (Five Months)

Total Credit Hours for IV semester: 26



Basic Medical Microbiology

Course Code	MMB501
Course Title	Basic Medical Microbiology
Type of course	CC
LTP	4 0 0
Credits	4
Course prerequisite	B.Sc. MLS or B.Sc. (Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.
Course Objective	 The aim of this course is to enable the students to: 1. Learn the principles and techniques of microbiology to enable them to isolate and identify the causative micro-organisms. 2. Proficiently supervise and perform full range of clinical laboratory investigations related to Medical Microbiology.
Course Outcomes	At the conclusion of the course, the students will: 1. Get about the historical events and developments in Microbiology. 2. Familiarization with sterilization techniques, Use of standard safety measures while handling infective materials. 3. Understand the process of cultivation through culture media and know about the nutritional requirements of microbes. 4. Knowledge of disposal of infected & non-infected laboratory waste.

IINIT-I

Overview of microbial world: Historical background, Classification- Purpose, Basic principles and Classification systems, general characteristics of prokaryotes and eukaryotes, scope of medical microbiology.

UNIT- II

Control of microorganisms: Sterilization and disinfection: Physical methods -Heat -Autoclaves, hot air oven, Filtration, Radiation, Chemical methods- Disinfectants, Antiseptics, Testing of disinfectants. Disinfection of thermo labile equipments, Sporicidal agents, Mycobacterial disinfection, Quality control in sterilization

UNIT-III

Growth, survival of micro-Organisms: common nutrient requirements, nutritional types of microorganisms, growth curve, continuous culture and synchronous growth, influence of environmental factors on growth, culture media and its types aerobic & anaerobic cultures.

Culture media: Introduction, classification of culture media (solid media, liquid media, semisolid, Media, simple media, complex media, synthetic/defined media, routine culture media, basal media, enriched, enrichment, Selective, Indicator/differential media, sugar fermentation media, transport media, preservation media, aerobic media, and anaerobic media).

UNIT-IV

Bacterial morphology: Anatomy of a bacterial cell including spores, flagella and capsules.

Bacterial Genetics: Structure and replication of bacterial DNA plasmids, Variation- Mutation; Transfer of genetic material; Recombinant DNA technology.

Collection and Transportation and disposal of Laboratory/ Hospital Waste: Non- Infectious Waste, Infected Sharp Waste Disposal, Infected Non- Sharp Waste Disposal.

S.No	Name/Title	Author	Publisher
1	Text book of Microbiology	Ananthanarayanan & Paniker	Universities press pvt. Ltd
2	Medical Microbiology	Panjarathinam R	New Age International
3	Medical laboratory Technology	Mukherjee	McGraw Hill Co., New York.
4	Text book of Microbiology	Prescott	McGraw Hill Co., New York.
5	Practical Medical Microbiology	Mackie and Mac. Cartney	Mackie and Mac. Cartney

Systematic Bacteriology

Course Code	MMB505			
Course Title	Systematic Bacteriology			
Type of course	CC			
LTP	4 0 0			
Credits	4			
Course prerequisite	B.Sc. MLS or B.Sc. (Applied Medical Science/Biosciences/Medical Science & Allied			
	Medical/Life Sciences) with 50% aggregate marks or it is equivalent.			
Course Objective	The aim of this course is to enable the students to:			
	1. Know about different types of bacteria on the basis of their characteristics features			
	2. Culture procedures, staining procedures and biochemical tests used for their			
	identification.			
Course Outcomes	At the conclusion of the course, the students will:			
	1. Understand the role of instruments for culturing & isolation of bacteria.			
	2. Apply the knowledge to differentiate & identify bacteria on the basis of staining			
	characterization.			
	3. Differentiate a large number of common bacteria by their characteristics features &			
	classify bacteria into groups			
	4. Learn the morphology cultural characteristics, biochemical characteristics &			
	laboratory diagnosis of various bacteria.			

UNIT- I

Bacterial culture

a. Instruments used to seed culture media

b. Culture procedures – spread plate method, Pour plate method

Staining techniques: Principal & procedure of simple, negative, differential & organelle stain and their significance

UNIT-II

Microbial identification: Principle, procedures and interpretation of the following biochemical tests for the identification of bacteria (Catalase, Coagulase, Indole, Methyl Red, Voges Proskauer, Urease, Citrate, Oxidase, Nitrate reduction, Carbohydrate fermentation, H₂S production etc.)

UNIT- III

Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria:

Gram Positive Bacteria: Staphylococcus, Streptococcus, Pneumococcus, Corynebacterium, Bacillus, Clostridium Gram Negative Bacteria: Neisseria, Pseudomonas aeruginosa, Vibrio, Haemophilus influenzae, Campylobacter jejuni

UNIT-IV

Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria:

Enterobacteriaceae: E. coli, Klebsiella, Shigella, Salmonella, Proteus, Acinetobacter, Enterobacter, Citrobacter

Miscellaneous bacteria: Mycobaterium tuberculosis, Mycoplasma, Rickettsia, Chlamydiae, Actinomycetes (Actinomyces, Nocardia), Brucella, Listeria monocytogenes, Spirochaetes

S. No.	Name/Title	Author	Publisher
1	Text book of Microbiology	Ananthanarayanan & Paniker	Universities Press Pvt. Ltd
2	Medical Microbiology	Panjarathinam R	New Age International
3	Text book of Microbiology	Prescott	McGraw Hill Co., New York.
4	Practical Medical Microbiology (Volume 1 and 2)	Mackie & McCartney	Churchill Living Stone

Molecular Biology

Course Code	MMB515	
Course Title	Molecular Biology	
Type of course	CC	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	 The aim of this course is to enable the students to: Understand the organization and functional unit of genome. Understand biosynthesis of DNA, RNA and proteins and their regulation as well as interactions between these macromolecules. 	
Course Outcomes	At the conclusion of the course, the students will get: 1. Comprehensive knowledge of molecular biology of bacteria, viruses and eukaryotes and their underlying principles. 2. Also be rendered to sensitize students to take up future molecular biology challenges.	

UNIT-I

Introduction: History of molecular biology, Importance of Molecular Biology, Central dogma of Molecular Biology, Model organisms for studying Molecular Biology

Structure and function of genetic material: Secondary and tertiary structure of nucleic acids; Types of RNA - rRNA, tRNA and mRNA, Watson Crick model of DNA, forms of DNA (A, B and Z), DNA supercoiling.

Genome and its organization: Introduction of genome, introns and exons, nucleosomes structure and packaging of DNA, Genetic code and its properties, Wobble hypothesis.

UNIT-II

DNA Replication: Proof of semiconservative nature of DNA replication, DNA polymerases, Features of bidirectional DNA replication in pro & eukaryotes, Causes and type of DNA damage and repair mechanisms (mis-match, base excision, nucleotide excision, recombination repair and role of rec A protein.

Molecular basis of mutation, types of mutation (missense mutation, nonsense mutation, silent mutation, point mutation, frameshift mutation

UNIT-III

Transcription: RNA structure and types of RNA, Transcription in prokaryotes and eukaryotes, Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains, Processing of RNA, mRNA capping and polyadenylation, RNA splicing

Translation: Components of translational machinery (mRNA, tRNA, ribosomes and aminoacyl tRNA synthetases), Mechanism of translation: Initiation, elongation and termination, Post translational modifications of proteins.

UNIT-IV

Regulation of Gene Expression: Principles of gene regulation, negative and positive regulation, Concept of operons, Regulation of gene expression in bacteria: lac operon concept

	t Water the Books		
S.No.	Name/Title	Author	Publisher
1	Molecular Biology, 2 nd edition (2004)	David Freifelder	Narosa Publishing House
2.	Molecular Biology	Dr. P.S. Verma, Dr. V.K. Agarwal	S.Chand Publications
3.	Molecular Biology of the Gene (6 th edition)	Watson JD, Baker TA, Bell SP, Gann A, Levine M and Losick R (2008)	Cold Spring Harbour Laboratory Press, Pearson Publication.
4.	Gene – VIII, 8 th edition (2004)	Benjamin Lewin	Oxford University Press
5.	Advanced Molecular Biology, 1st Edition, (2003)	R. M. Twyman	

Bio-analytical Techniques

Course Code	MMB519		
Course Title	Bio-analytical Techniques		
Type of course	CC		
LTP	3 0 0		
Credits	3		
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science		
	& Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.		
Course Objective	The aim of this course is to enable the students to: 1. Understand the principles and procedures of biochemical and biophysical methods used for extraction, separation, purification, estimation and		
	characterization of compounds of clinical importance in analytical biochemistry		
	To impart knowledge about the radio diagnostic techniques		
Course Outcomes	At the conclusion of the course, the students will:		
	1. Learn the principle, parts and application of various instruments commonly		
	used in medical laboratories.		
	2. Understand the working principle of separation techniques in biology like		
	electrophoresis, centrifugation, chromatography		

UNIT- I

Microscopy: Principle & applications of Light microscope, Phase contrast microscope and Fluorescence microscope. General principle and applications of Electron microscope (TEM & SEM), Principle and applications of con-focal microscopy

Cryo-techniques: Cryopreservation of cells, tissues, organs and organisms, Freeze fracture & freeze drying. Principles of tissue fixation, Microtomy, cryotomy.

UNIT-II

Principles and applications of photometry: Absorption of light, Transmittance, Absorbance (Optical density), Lambertbeer law, Method of determining Absorption spectrum of copper sulphate by spectrophotometer, Colorimeter & spectrophotometer; Flame photometer; Atomic absorption spectrophotometer.

UNIT-III

Separation Techniques: Basic principle of sedimentation, Relative centrifugal force (RCF), Sedimentation rate, sedimentation coefficient, Isopycnic (equilibrium) sedimentation and theory of ultracentrifugation.

Electrophoresis: Principle, Types & Applications- PAGE and Agarose Gel Electrophoresis.

UNIT-IV

Chromatography: Principle, types and applications of Paper, TLC and column chromatography, Gas Chromatography, Ion exchange and Affinity chromatography and HPLC.

Radioisotopes in biology: Radioactive decay and units of radioactivity, Different types of radioisotopes used in diagnosis. Principles of Radioactive counters (GM and Scintillation counters), Autoradiography, Radiation dosimetery and safety guidelines

S.No.	Name/Title	Author	Publisher
1	Handbook of Microscopy	Locquin and Langeron	Butterwaths
2	Modern Experimental Biochemistry	Boyer	Benjamin
3	Practical Biochemistry	Wilson and Walker	Cambridge
4	Introduction to Instrumental analysis	Robert Braun	McGraw Hill Int.
5	Experimental Biochemistry	Clark & Switzer	Freeman Publ.
6	Bioinstrumentation	Veerakumari (2011)	MJP Publishers
7	Instrumental Methods of Analysis	Wliard, Merritt, Dean, Settle	Tata McGraw Hill Publishing Co. Ltd., New Delhi
8	Physical biochemistry: Principles and Applications	Sheehan, D. (2000)	John Wiley and Sons Ltd., Chicester, England

Bioethics, Biosafety & Intellectual Property Right

Course Code	MMB521	
Course Title	Bioethics, Biosafety & Intellectual Property Right	
Type of course	SECC	
LTP	3 0 0	
Credits	3	
Course prerequisite	M. Sc. Medical Microbiology as Skill Enhancement Course	
Course Objective	The aim of this course is to enable the students to: 1. Inculcate the knowledge of intellectual property right to students and aware them about Patents, trademark, copyright etc. 2. Know about importance of biosafety levels and biological containment for safe utilization of technocnology	
Course Outcomes	At the conclusion of the course the students will: 1. Understand the concept, scope and importance of IPR. 2. Know about patents, copyrights, trademarks and industrial designs. 3. Get awareness of acquiring the patent and copyright for the innovative works.	

UNIT I

Ethics: Benefits of Ethics, ELSI of Bioscience, recombinant therapeutic products for human health care, genetic modifications and food consumption, release of genetically engineered organisms, applications of human genetic rDNA research, human embryonic stem cell research.

Bio safety regulation of products microbial products and biosphetic concerns individual society National and international bio safety regulations in Laboratories handling of Recombinant products

UNIT II

Introduction to intellectual property right (**IPR**): Concept and kinds. Economic importance, IPR in India and world: Genesis and scope, some important examples.IPR and WTO (TRIPS, WIPO)

Patents: Objectives, Rights, Patent Act 1970 and its amendments, Types of patents, Procedure of obtaining patents, working of patents and Infringement.

Copyrights: Introduction, Works protected under copyright law, Rights, Transfer of Copyright, Infringement.

UNIT III

Trademarks: Objectives, Types, Rights, Protection of goodwill, Infringement, Passing off, Defenses, Domain name. **Industrial Designs:** Objectives, Rights, Assignments, Infringements, Defenses of Design Infringement

UNIT IV

Biotechnology and Intellectual Property Rights: Patenting Biotech Inventions: Objective, Applications, Concept of Novelty, Concept of inventive step, Microorganisms, Moral Issues in Patenting Biotechnological inventions, Biosafety and its implementation

S.No.	Name/Title	Author	Publisher
1	Textbook on intellectual property rights	N.K. Acharya	Asia Law House (2001).
2	Understanding Trips: Managing Knowledge in Developing Countries	Manjula Guru & M.B. Rao	SagePublications (2003).
3	Intellectual Property Rights: Unleashing the Knowledge Economy,	P. Ganguli,	Tata McGraw-Hill (2001).
4	Intellectual Property: Patents, Trademarks and Copyright in aNutshell	Arthur Raphael Miller, MichealH.Davis	West Group Publishers (2000).
5	Intellectual property rights in the WTO and developing countries,	Jayashree Watal	Oxford University Press, Oxford

Biostatistical Methods

Course Code	MAT515	
Course Title Biostatistical Methods		
Type of course	ID	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLS or B.Sc. (Applied Medical Science/Biosciences/Medical Science & Allied	
	Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to:	
	1. To give the knowledge of statistical techniques used in life sciences for simplification	
	of complex things, so that they can be easily understood.	
	2. Learn methods to collect, analyze, interpret and presenting the raw data.	
Course Outcomes At the conclusion of the course, the students will:		
	 Able to calculate and apply measures of location and measures of dispersion grouped and ungrouped data cases 	
2. Learn to apply discrete and continuous probability distributions to		
	problems.	
	3. Implement knowledge to compute and interpret the results of Bivariate and	
	Multivariate Regression and Correlation Analysis, for forecasting and also perform	
	ANOVA and F-test	

UNIT-I

Data collection, tabulation, Frequency distribution and its graphical representation

Measures of Central tendency: mean, mode, median

Measures of Dispersion: range, variance, Standard deviation and Standard error

UNIT II

Probability: Mathematical definition of a probability event; Conditional probability; Additive and Multiple law of

Probability

Theoretical Distributions: Binomial, Poisson and Normal

UNIT III

Null Hypothesis and Level of Significance; Confidence limit and confidence interval; Skewness and Kurtosis moments Student's t- test (Paired and unpaired); Chi Square test

UNIT-IV

Correlation: Covariance, Karl pearson's correlation coefficient and Spearmans rank correlation coefficient

Regression: Least square technique for regression lines, regression coefficient; Relation between Correlation and

Regression

Analysis of variance (one way and two way ANOVA)

S.No.	Name/Title	Author	Publisher
1	Introduction to Mathematics for Life Scientists	Batschelet, E	Springer-Verlag, Berlin
2	Mathematical Biology	Murray, J.D.	Springer-Verlag, Berlin
3	Statistical Methods	Snedecor&Cochran	Affliated East-West Press
4	Biostatistics	P. Ramakrishnan	Saras Publications
5	Biostatistics: Basic Concepts and Methodology for the Health Sciences	Wayne W. Daniel	Wiley Publication

Basic Medical Microbiology - Practical

Course Code	MMB503	
Course Title	Basic Medical Microbiology – Practical	
Type of course	CC	
LTP	0 0 4	
Credits	2	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Impart the practical knowledge of different procedures for processing and identification of various bacteria using different techniques. 2. Proficiently perform full range of microbiological laboratory investigations.	
Course Outcomes	At the conclusion of the course, the students will: 1. Demonstrate the different morphological types of bacteria aided by different staining (Simple, differential & special) techniques. 2. Able to prepare different type of media to cultivate organisms. 3. Know the effect of nutritional & environmental factors on microbial growth.	

LIST OF PRACTICALS

1. To demonstrate the different morphological types of bacteria.

2. Preparation and sterilization of the culture media

- To study the method of sterilization by autoclave & hot air oven
- To prepare nutrient agar media for the isolation of bacteria
- To prepare working dilution of commonly used disinfectants.

3. Effect of nutritional factors on growth

• To study the effect of different carbon & nitrogen sources on the growth of microorganisms

4. Effect of environmental factors on growth

- To study the effect of pH on the growth of microorganisms
- To study the effects of UV radiation on growth of microorganisms

Systematic Bacteriology – Practical

	Systematic Ductoriology Truction	
Course Code	MMB507	
Course Title	Systematic Bacteriology – Practical	
Type of course	CC	
LTP	0 0 4	
Credits	2	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Impart hands on practice on various types of culturing and staining procedures 2. Perform biochemical tests used for bacterial identification	
Course Outcomes	At the conclusion of the course, the students will: 1. Understand the basic laboratory practices in the field of bacteriology 2. Apply this knowledge to identify the bacteria from different types of samples through morphological and biochemical characterization.	

LIST OF PRACTICALS

- 1. To demonstrate the instruments used to seed culture media
- 2. To learn techniques for Inoculation of bacteria on culture media
- 3. To isolate specific bacteria from a mixture of organisms.
- 4. To demonstrate simple staining (Methylene blue)
- 5. To prepare India ink preparation to demonstrate negative staining.
- 6. Bacterial identification: To demonstrate reagent preparation and procedure for
 - Gram stain
 - Albert stain
 - Neisser's staining
 - Z-N staining
 - Capsule staining
 - Demonstration of flagella by staining methods
 - Spore staining
- Fontana stain
- 7. Physiological tests of bacteria
 - To perform IMViC test
 - To perform Urease, Oxidase and Catalase test

Molecular Biology – Practical

Course Code	MMB517	
Course Title	Molecular Biology – Practical	
Type of course	CC	
LTP	0 0 2	
Credits	1	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Students will be equipped with knowledge to handle DNA in vitro. 2. They will have hands on practice on isolation, quantitative determination and purification of DNA & RNA.	
Course Outcomes	At the conclusion of the course, the students will: 1. To understand the process of DNA isolation and quantification of DNA & RNA 2. Apply this knowledge to estimate microbial growth.	

LIST OF PRACTICALS

- 1. Preparation of buffers used in molecular biology
- 2. Isolation of genomic DNA
- 3. Isolation of plasmid DNA
- 4. Isolation of DNA from human blood
- 5. Isolation of RNA
- 6. Estimation of DNA by diphenylamine reaction.
- 7. Estimation of RNA by orcinol method
- 8. Measure the OD ratio at 260 and 280 nm for supplied DNA and protein samples.
- 9. Separation of DNA fragments on agarose gel electrophoresis.
- 10. Demonstration of PCR

S.No.	Name/Title	Author	Publisher
1	Molecular Cloning: A Laboratory	Sambrook Joseph and Russell	Cold Spring Harbor Laboratory
	Manual	DW	Press, NY
2	Current Protocols in Molecular	Ausbel FM, Brent R, Kingston	Greene Publishing and Wiley
	Biology	RE, Moore DD, Sediman JG,	Interscience, NY
		Smith JA, Sruhi V	



Applied Bacteriology

Course Code	MMB502	
Course Title	Applied Bacteriology	
Type of course	CC	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Understand the pathogenicity of various bacteria mentioned in the syllabus. 2. Learn the various methods for the laboratory diagnosis of different disease causing bacteria.	
Course Outcomes	At the conclusion of the course, the students will: 1. Explain about applications of microbiology such as microbial pathogenicity & laboratory diagnosis of various infective syndromes 2. Demonstrate antibiotic susceptibility testing in bacteriology. 3. Know the collection, transportation and processing of bacteriological examination of water, milk, food, air samples & methods to preservation of microbes.	

UNIT I

Laboratory strategy in the diagnosis of various Infective syndromes: Samples of choice, Collection, transportation and processing of samples for laboratory diagnosis of the following complications: Urinary tract infections, Septicemia and bacteremia, Upper Respiratory tract infections, Lower Respiratory tract infections, Wound, skin, and deep sepsis, Enteric fever, Pyrexia of unknown origin, Genital Tract infections, Meningitis, Gastro intestinal infections, Tuberculosis (Pulmonary and Extra-pulmonary)

UNIT II

Antibiotic susceptibility testing in bacteriology: Definition of antibiotics, Culture medium used for Antibiotic susceptibility testing, Preparation and standardization of inoculums, Control bacterial strains, Choice of antibiotics, MIC and MBC: Concepts and methods for determination, Various methods of Antibiotic susceptibility testing with special reference to Stokes method and Kirby-Bauer method, Tests for production of β-lactamase

UNIT III

Bacteriological examination of water, milk, food and air:

Examination of water: Collection and transportation of water sample, Presumptive coliform count Eijkman test, Introduction and importance of other bacteria considered as indicators of fecal contamination, Membrane filtration tests, Interpretation of results

Examination of Milk and milk products: Basic Concepts regarding gradation of milk, Various tests for Bacteriological examination

Examination of food articles: Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc., Various tests for Bacteriological examination with special reference to food poisoning bacteria

Examination of Air: Significance of air bacteriology in healthcare facilities, Settle plate method, Types of air sampling instrument, Collection processing and reporting of an air sample

INIT IN

Sterility testing of I/v fluids: Collection, transportation and processing of I/v fluids for bacterial contamination, Recording the result and interpretation

Preservation of microbes and Iyophilisation methods

Epidemiological markers: Serotyping, Phage typing, Bacteriocin typing.

Nosocomial Infection: Introduction, sources and types of nosocomial infections, Bacteriological surveillance of hospital

environment, Role of microbiology laboratory in control of nosocomial infections

S. No.	Author(s)	Title	Publisher
1	Ananthanarayan and Paniker	Text book of Microbiology	Universities Press
2	Michael J. Pelczar, JR. E.C.S Chan & Noel R. Krieg	Text book of Microbiology	Tata McGraw Hill
3	D.R Arora& B. Arora	Text book of Microbiology	CBS Publisher
4	KL Mukherjee	Medical laboratory Technology Volume-II(2 nd Ed.)	Tata McGraw Hill



Medical Parasitology

Course Code	MMB506	
Course Title	Medical Parasitology	
Type of course	CC	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Understand the host-parasite relationships of various parasites 2. Learn about the different types of parasites their life cycle, pathogenicity and diagnosis in laboratory.	
Course Outcomes	At the conclusion of the course, the students will: 1. Identify parasitism, parasites and their examples 2. Comprehend the techniques for diagnosis of parasites 3. Know the role of vectors in spreading the parasitic diseases.	

IINIT-I

Introduction to Medical Parasitology: Classification of parasites, host-parasite relationships, parasitism, routes of infection, organs and tissues affected, host response to parasite infections, zoonoses. Diagnostic Procedures: Collection, Transport, processing and preservation of samples for routine parasitological investigations, Stool examination (Gross examination of stool, microscopic examination, concentration methods), Examination of blood for parasites.

UNIT-II

Protozoans

Intestinal and vaginal flagellates: Morphology, life cycle, mode of infection and laboratory diagnosis of Giardia, Trichomonas sp.

Blood and tissue flagellates: Morphology, life cycle, Mode of infection and laboratory diagnosis of Trypanosoma brucei gambiense, Leishmania donovani, Plasmodium spp., Toxoplasma gondii, Cryptosporidium parvum

UNIT-III

Cestodes: Morphology, life cycle, mode of infection and laboratory diagnosis of Taenia solium, Taenia saginata, Echinococcus granulosis, Hymenolepis nana Trematodes: Morphology, life cycle, mode of infection, and laboratory diagnosis of Schistosoma mansoni, Schistosoma haematobium, Paragonimus westermanni, Fascioloa hepatica

UNIT-IV

Nematode-I: Morphology, life cycle, mode of infection and lab diagnosis of Ascaris lumbricoides, Ancyclostoma duodenale, Trichinella spiralis, Trichuris trichiura.

Nematode-II: Morphology, life cycle, mode of infection and lab diagnosis of Enterobius vermicularis, Wuchereria bancrofti, Brugia malayi, Strongyloides stercoralis, Dracunculus medinensis.

S.No.	Name/Title	Author	Publisher
1	Protozoology and helminthology. Ltd	Chatterjee KD	CBS Publishers & Distributors
			Pvt. Ltd
2	Medical Parasitology	Arora BB	CBS Publishers &
			Distributors Pvt. Ltd.
3	Textbook of Medical Parasitology	Ck Jayaram Paniker	Jaypee Brothers Medical
			Publishers (P) Ltd
3	Essentials of Medical Parasitology	Apurba sankar sastry and sandhya	Jaypee Brothers Medical
		bhat	Publishers Pvt. Ltd.

Biochemistry and Metabolism

Course Code	MMB 510	
Course Title	Biochemistry and Metabolism	
Type of course	CC	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLS or B.Sc. (Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective (CO)	The aim of this course is to enable the students to: 1. Provides the knowledge regarding structure and function of major biomolecules- carbohydrates, lipids, proteins, amino acids and nucleic acids. 2. Provides a clear Understanding about the biosynthesis and degradation pathways involved.	
Course Outcomes	At the conclusion of the course, the students will: 1. Deals with the physiological processes and metabolic pathways in microbial systems like carbohydrates, lipids etc. 2. Understand structural and functional co-relationships and underlying molecular mechanisms 3. Also imparts knowledge of understanding the enzyme kinetics involved in microbial systems	

IINIT.I

Carbohydrates: Structure of sugars, classification, properties, chemical reactions, stereoisomerism and optical isomers of sugars. Structure, properties and function of disaccharides, oligosaccharides, and polysaccharides, carbohydrate derivatives and their biological importance, peptidoglycan, glycoproteins, glycolipids

Lipids: Classification, structure, properties and functions of fatty acids, triacylglycerols, phospholipids, sphingolipids, sterols and terpenes

UNIT-II

Amino acids: Structure, classification, properties and functions.

Proteins: Structural and functional proteins, synthesis of peptide bonds, Primary, secondary, tertiary and quaternary structure of proteins.

Nucleic acids: Structure and properties of purines and pyrimidine bases, nucleosides and nucleotides, Basic structure and types of DNA and RNA.

UNIT-III

Enzymes: Basic concept as a biocatalyst, enzyme nomenclature and classification. Enzyme specificity, active sites, activity unit and isozymes

Enzyme kinetics: Michaelis-Menton equation for simple enzymes, determination of kinetic parameters (V_{max} and K_m)

Enzyme inhibition and regulation: Reversible (competitive, noncompetitive and uncompetitive inhibition) and Irreversible inhibition, Regulatory enzymes (allosteric regulation), Reversible covalent modification and zymogen activation

Carbohydrate metabolism: Glycolysis and its regulation, Glycogenesis, Glycogenolysis and regulation, Gluconeogenesis, Pentose phosphate pathway

ATP synthesis: Electron transport chain, Substrate level and oxidative phosphorylation.

UNIT-IV

Lipid Metabolism: Degradation of Lipids, oxidation of unsaturated, saturated, even and odd chain fatty acids, ketone bodies. **Amino acid metabolism:** General reactions: Transamination, Deamination and Decarboxylation. Breakdown of amino acids into six common intermediates and urea cycle

Nucleotide metabolism: Biosynthesis of purines and pyrimidine nucleotides by de-novo and salvage pathways, Degradation of purines and pyrimidines

S. No	Name	Author(S)	Publisher
1.	Lehninger Principles of Biochemistry	David L. Ne Ison and Mic hael M. Cox	W.H. Freeman and Company;2008, 5 th edition
2	Biochemistry	GeoffreyL.Zubay.F	Adison-Wesley educational publishers lnc.,2008, 4 th edition
3	Practical Clinical Biochemistry	Harold Varley	CBS Publishers & Distributers
4	Text book of Medical Biochemistry	M N Chaterjee and R. Shinde	Jaypee Brothers Medical Publishers(P) Ltd.



Antimicrobial Agents and Chemotherapy

Course Code	MMB 514	
Course Title	Antimicrobial Agents and Chemotherapy	
Type of course	DSE	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Provide knowledge about antibacterial, antiviral agents 2. Understand the types and mode of action common antimicrobial drugs	
Course Outcome	At the conclusion of the course, the students will: 1. Able to acquire conceptual knowledge of antimicrobial agents 2. Able to provide an overview of the mode of action of antibiotics 3. Able to understand the mechanism involved of the chemotherapeutic agents in subsiding the microbial activities.	

UNIT I

History of chemotherapy, Types of antimicrobial agents, Paul Ehrlich and his contributions to chemotherapy. Chemical non-medicinal antimicrobials- sanitizers, disinfectants, antiseptics

Antibiotics – Definition of antibiotics, types (chemical) of antibiotics, cell wall inhibitors, membrane inhibitors, inhibitors of macro-molecular synthesis, anti metabolites.

UNIT II

Bactericidal and bacteriostatic agents: Factors affecting static and cidal activity, phenols and phenolic compounds, alcohols, halogens, heavy metals, dyes, detergents, aldehydes, Non-medical uses of antibiotics.

UNIT III

Antiviral agents: Biological antiviral agents- interferon and its action, chemical antiviral agents, Phenomenon of drug resistance, basis of drug resistance, biochemistry of drug resistance, genetics of drug resistance. Control of drug resistant bacteria

Unit IV

Mode of action of important drugs – Cell wall inhibitors (betalactam drugs), membrane inhibitors (polymyxin), Ribosomal inhibitors (aminoglycosides – streptomycin), folic acid inhibitors (sulfa drugs), antifungal drugs (nystatin)

S.No.	Name/Title	Author	Publisher
1	Pharmaceutical microbiology, 8 th Ed.	Hugo Russell	John Willey & Sons
2	Biochemistry of antimicrobial action	Transitin, 15 and 5no ii, 2	Cbs Publishers and Distributors Pvt. Ltd
3	Antibiotics and chemotherapy, 9 th Ed.	Gerrod et al	Saunders, Publishers

Laboratory Organization and Management

Course Code	MMB516	
Course Title	Laboratory Organization and Management	
Type of course	DSE	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied	
	Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to:	
· ·	1. Aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab.	
	2. Understand sample accountability, quality management system, calibration and validation	
	of clinical laboratory instruments, Laboratory Information system (LIS)Chromatograph	
	and automation in Clinical Biochemistry etc.	
Course Outcomes The students will able to:		
	1. Understand the ethical and clinical responsibilities towards the patient, colleagues and	
	society	
	2. Know the importance of GLP and merits of GLP	
	3. Understand the importance of quality and quality parameters.	

UNIT I

Ethical Principles and standards for a clinical laboratory professional:

Duty to the patient, Duty to colleagues and other professionals, Duty to the society

Good Laboratory Practice (GLP) Regulations and Accreditation:

Introduction to Basics of GLP and Accreditation, Aims of GLP and Accreditation, Advantages of Accreditation, Brief knowledge about National and International Agencies for clinical laboratory accreditation

UNIT II

Awareness / Safety in a clinical laboratory: General safety precautions, HIV: pre- and post-exposure guidelines, Hepatitis B & C: pre- and post-exposure guidelines, Drug Resistant Tuberculosis

Patient management for clinical samples collection, transportation and preservation

UNIT III

Sample accountability: Purpose of accountability, Methods of accountability

Sample analysis: Introduction, Factors affecting sample analysis

Reporting results: Basic format of a test report, Reported reference range, Clinical Alerts, Abnormal results, Turnaround time, Results from referral laboratories, Release of examination results, Alteration in reports

Quality Management system: Introduction, Quality assurance, Quality control system, Internal and External quality control, Introduction and importance of calibration and Validation of Clinical Laboratory instruments

UNIT IV

Laboratory Information system (LIS), Hospital Information system (HIS) and financial Management: Introduction, Functions of a laboratory management system, Standards for laboratory management system, Introduction and awareness of financial management in a clinical laboratory

S. No	Name	Author(S)	Publisher
1.	Medical Laboratories Management-	Sangeeta Sharma, Rachna Agarwal,	Viva Books Pvt. Ltd.
	Cost effective methods	Sujata Chaturvedi and Rajiv Thakur	
2	K.L. Mukherjee	Medical Laboratory Technology	Jaypee Brothers Medical
			Publishers(P) Ltd.

Medical Anatomy & Physiology-I

Course Code	MMB518	
Course Title	Medical Anatomy & Physiology-I	
Type of course	DSE	
LTP	3 0 0	
Credits	3	
Course prerequisite	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.	
Course Objective	The aim of this course is to enable the students to: 1. Identify and relate basic concepts of structure and function of cells, tissues and organs. 2. Understand the anatomical organization, coordination and integrated functions of human body.	
Course Outcomes	At the conclusion of the course, the students will: 1. Be able to explain the anatomy, physiology and functions of various organs mentioned in chapters. 2. Understand the structure and function of blood and lymphatic system 3. Apply concepts and knowledge of terminology related to the musculoskeletal, cardiovascular, Integumentary and Endocrine system	

UNIT-I

General anatomy: Anatomical terminology, Anatomical planes, Anatomical positions, Clinical positions, Terms related to movements.

Basics of cytology: Structure of cell membrane, Cell organelles, Junctional complexes

Cell Physiology: Membrane transport, Bio-membrane potentials, Nernst equation, Composition of ECF and ICF, Goldmann equation

UNIT-II

Musculoskeletal system: Bones & their classification, Morphology, ossification, blood supply

Muscles: Morphology, classification, blood supply, innervations, functions

Nervous system: Central Nervous system & Peripheral Nervous system, Gross basic Anatomy, Cranial nerves, Spinal nerves, Functions of nerves, Autonomic nervous system

Nerve Muscle: Neuron (structure, functions and classification) and neuroglia, Action potential, neuromuscular junction, Skeletal muscle (structure, mechanism of contraction), Smooth muscle (structure, mechanism of contraction)

UNIT-III

Cardiovascular system: Morphology of blood vessels, classification of blood vessels, blood capillaries, blood circulation, functions, Cardiac muscle, Physiological Anatomy of heart and conduction system, Normal ECG, cardiac cycle, heart sounds, Cardiac output and blood pressure, Coronary circulation.

Lymphatic system: Formation of lymph, Lymphatic ducts, Thoracic duct, Lymph circulation, functions

UNIT-IV

Blood: Function and composition, Erythrocytes, Hemoglobin, Blood groups, Leucocytes, Thrombocytes

Respiration: Functional Anatomy of the respiratory system, Mechanism of breathing, dead space, surfactant, dynamic and static lung volumes and capacities, Transport of oxygen and carbon dioxide, Regulation of respiration, Cyanosis, Hypoxia, Artificial respiration.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Anatomy & Physiology- Ross and	Anne Waugh & Allison Grant	Churchill Living Stone
	Wilson		
2	Anatomy and Physiology:	Robert Clark	Jones & Bartlett
	Understanding the Human Body		publishers
3.	Functional Histology	James S. lowe, Barbara young, Allen	Elsevier
		Stevens & John W heath	
4.	Text book of human Histology with	Inderjit singh	Jaypee Brothers Medical
	color Atlas and Practical Guide		publishers
5.	Understanding Human Anatomy	Willium Davis	McGraw Hill
	and Physiology		

Introductory Concepts of Computer Technology

Course Code	CSE554	
Course Title	Introductory Concepts of Computer Technology	
Type of course	ID	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Aware about the basic fundamentals of computer and its use in day today life. 2. Learn the basics of operating system mentioned in the syllabus	
Course Outcomes	At the conclusion of the course, the students will: 1. Understand Basics of computer and its operating system 2. Distinguish the types of Software 3. Learn the MS-Windows basics and applications	

UNIT--I

Evolution of computers; Basics of computer and its operation: Functional Components and their inter-connections, concept of Booting, Use of Operating System for directory listing, hierarchical directory structure, renaming, deleting files/folders, formatting floppy, copying files, concepts of path and pathname, switching between tasks, installation/removal of applications

UNIT--II

Computers and their applications in biology

Operating systems: Need for operating system, Functions of operating system (Processor Management, Memory Management, File Management and Device Management);

GBBSD

Types of operating system - Interactive (GUI based), Timesharing, Real Time and Distributed

Types of Software: System Software, Utility Software and Application Software

UNIT--III

Computer fundamentals, Introduction to digital computers, Organization; Number system, I/O devices, Storage devices; Introduction to internet and its applications – www, email

UNIT--IV

MS-Windows basics

MS-Word: Meaning of Word–Processing, Creating, Saving, Printing documents, Formatting, Spell-Check, Adding page numbers, Header and Footer, Macros, Creating tables, Converting table to text and vice–versa, Mail Merge; MS-Excel: Spreadsheets, Using different types of formulae, Creating graphs and charts, Exporting charts to MS-Word MS-PowerPoint: Creating presentations, Formatting, Adding effects and timings.

S.No.	Name/Title	Author	Publisher
1	Computer Fundamentals	Sinha, P.K.	
2	Windows Based Computer Courses	Sumit Kumar,	JBD Publishers
3	Fundamentals of Computers	Rajaraman	Prentice Hall of India

Natural Hazards and Disaster Management

Course Code	EVS003	
Course Title	Natural Hazards and Disaster Management	
Type of course	AECC	
LTP	3 0 0	
Credits	3	
Course prerequisite	Graduation	
Course Objective	The aim of this course is to enable the students to:	
	Learn about natural hazards and risk assessment	
	2. Know the operation of disaster management framework in India and	
	Disaster Recovery-Strategy	
Course Outcomes	At the conclusion of the course the students will:	
	Learn the concept of natural hazards	
	2. Understand the role of Disaster management system	

UNIT I

Overview of natural hazards; Introduction to natural hazards, impact and mitigation in Global and Indian context; causes and consequences of geological hazards, flood, drought and climate change issues, forest hazard, tsunami and coastal hazards, cyclone hazards, snow avalanche, GLOF and glacier related hazards, extreme weather events, urban and industrial hazards.

UNIT II

Introduction to vulnerability and risk assessment, socio-economic and physical aspects of vulnerability and elements of risk mapping, assessment, and reduction strategies

SBBSD

UNIT III

Earth observation: Data availability and key operational issues for DM: EO systems for natural hazards study: present (operational) and future systems; multi-temporal data sources, multi-temporal database organization: Key operational issues, utilization of geo-information products for disaster management (available through International cooperation e.g. International Charter etc.)

UNIT IV

Disaster management framework of India and recent initiatives by Govt. of India with special emphasis on DRR HFA 2005-2015, MDG and SAARC comprehensive framework for DRR Disaster Management Support (DMS): Status in India for use of space inputs Mainstreaming DRR in Development Planning Sustainable development in the context of Climate Change Disaster Recovery-Strategy and case examples

S.No.	Name/Title	Author	Publisher
1	Environmental Hazards: Assessing Risk and Reducing Disaster	Keith Smith and Petley David, 2008.	Routledge
2	Geo-information for Disaster Management	van Oosterom Peter, ZlatanovaSiyka and Fendel Elfriede, 2005	Springer-Verlag
3	Geospatial Techniques in Urban Hazards and Disaster Analysis	Showalter, Pamela S. and Lu, Yongmei, 2010.	John Wiley and Sons.
4	An International Perspective on Natural Disaster: Occurrence, Mitigation and Consequences	Stoltman JP, Lidstone J and Dechano LM., 2004.	Kluwer Academic Publishers

Applied Bacteriology (Practical)

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Course Code	MMB504	
Course Title	Applied Bacteriology (Practical)	
Type of course	CC	
LTP	0 0 4	
Credits	2	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	 The aim of this course is to enable the students to: Provide knowledge of the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation Understand the processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing. 	
Course Outcomes	At the conclusion of the course, the students will: 1. Understand the basic laboratory practices in the field of bacteriology 2. To perform antibiotic susceptibility testing of clinical isolates by using standard method. 3. Able to collect, transport and process various clinical samples & preserve the isolates.	

SBBSD

LIST OF PRACTICALS

- 1. Inoculation of different culture media
- 2. Isolation of pure cultures
- 3. Processing of following clinical samples for culture and identification of pathogens:
 - Blood
 - Throat swab
 - Sputum
 - Pus
 - Urine
 - Stool for Salmonella, Shigella and Vibrio cholera
 - C.S.F. and other body fluids
- 4. To perform antibiotic susceptibility testing of clinical isolates by using
 - Stokes method and
 - Kirby-Bauer method
- 5. Collection, transportation and processing of following articles for bacteriological examination:
 - water,
 - milk
 - food and
 - air samples
- 6. To demonstrate sterility testing of intravenous fluid with positive and negative controls
- 7. Demonstration of serotyping and bacteriocin typing
- 8. Demonstration of lyophilization
- 9. To learn 'How to dispose of bacterial cultures'

S. No.	Author(s)	Title	Publisher
1.	Mackie &Mac Cartney	Practical Medical Microbiology Volume 1 and Volume 2	Churchill Living Stone
2.	KL Mukherjee	Medical laboratory Technology Volume-II	Tata McGraw Hill (2 nd Ed.)

Medical Parasitology (Practical)

Course Code	MMB508	
Course Title	Medical Parasitology (Practical)	
Type of course	CC	
LTP	0 0 4	
Credits	2	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Understand the general characteristics and the disease caused by various protozoans and helminths. 2. Learn various staining and concentration techniques for the identification of parasites	
Course Outcomes	At the conclusion of the course, the students will: 1. Perform the examination of stool, blood and sputum samples for diagnosis of disease. 2. Demonstrate various staining techniques. 3. Comprehend the techniques for diagnosis of parasites.	

LIST OF PRACTICALS

1. Stool and sputum examination

- Routine examination of stool and sputum for parasitic infections by macroscopic examination
- Routine examination of stool and sputum for parasitic infections by microscopic examination
- Preparation of permanently stained smear of the stool sample

2. Giemsa stain

• To prepare and perform the Giemsa stain for the identification of malarial parasite, Microfilaria from blood sample

3. Stool concentration methods

- To perform the saturated salt flotation method for stool concentration
- To perform the zinc sulfate centrifugal floatation method for stool concentration
- To perform the formol-ether sedimentation method for stool concentration

4. Leishman stain

• To prepare and perform the Leishman stain for the identification of malarial parasite, Microfilaria from blood sample

5. Field stain

To prepare and perform the Field stain for the identification of malarial parasite from blood sample

6. Jaswant Singh Bhattacharjee stain

• To prepare and perform the Jaswant Singh Bhattacharjee stain for the identification of malaria parasite from blood sample

7. Culture Methods

- Boeck and Drbohlav's diphasic medium
- Balamuth's monophasic liquid medium
- NNN medium
- Schneider's insect tissue culture medium

S.No.	Name/Title	Author	Publisher
1	Medical parasitology	V. Baveja, C.P. Bavej	4 th edition
2.	Medical parasitology	D.R. Arora	5 th edition

Biochemistry and Metabolism Lab

Course Code	MMB 512	
Course Title	Biochemistry and Metabolism(Practical)	
Type of course	CC	
LTP	0 0 4	
Credits	2	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	 The aim of this course is to enable the students to: Develop basic practical skills for handling and analysis of biomolecules Provide hands on practice about various qualitative and quantitative tests procedures for detection of carbohydrates, proteins and lipids. 	
Course Outcomes	At the conclusion of the course, the students will: 1. Able to identify and perform various biochemical tests 2. Able to apply their knowledge for the diagnosis and characterization of microbes	

LIST OF PRACTICALS

- 1. To detect the presence of carbohydrate in the given sample by Molish test, Fehling's test Benedict's test, Barfoed's reagent.
- 2. To detect the presence of pentose sugar in the given sample by Bial's test and ketose sugar by Seliwanof's reagent
- 3. To detect the presence of starch in given sample by using iodine solution
- 4. Qualitative tests of proteins and lipids.
- 5. Preparation of Buffers commonly used in biochemistry laboratory
- 6. To demonstrate the principle of spectrophotometry and verification of Beer law.
- 7. To determine the carbohydrates by anthrone method
- 8. To determine the proteins in given sample by Biuret method.
- 9. Quantification of protein contents in given sample by Folin's- Lowry method
- 10. To determine Saponification value of given fat sample.
- 11. Separation of lipids by TLC

	S.No.	Name/Title	Author	Publisher
	1	An Introduction to Practical	Plummer D	Tata McGraw Hill,
		Biochemistry		Publishing Co., New Delhi.
į	2	Modern Experimental Biochemistry	Boye	Pearson Education, Asia, New Delhi

Introductory Concepts of Computer Technology Practical

Course Code	CSE556		
Course Title	Introductory Concepts of Computer Technology Practical		
Type of course	ID		
LTP	0 0 2		
Credits	1		
Course prerequisite	B.Sc. Non Medical or B. Sc. Medical with Zoology as main subject		
Course Objective	The aim of this course is to enable the students to: 1. Aware about the basic fundamentals of computer and its use in day today life. 2. Learn the basics of operating system mentioned in the syllabus		
Course Outcomes	At the conclusion of the course, the students will: Learn the basics of computer and its operating system 2. Understand the working of different softwares 3. Learn the basics of MS-Word, MS-Excel, MS-PowerPoint		

I. Word Processor software

Word

To familiarize with parts of Word window, To create and save a document, page settings, create headers and footers, To edit a document and resave it, To use copy, cut and paste features. To create a table with specified rows and columns, To create a table with specified rows and columns, To select a table, a row, a column or a cell ,To insert new row and/or a column, To delete a row and/or a column

Excel

To familiarize with parts of Excel window, To create and save a workbook with single and/or multiple worksheets, To edit and format text as well numbers, To insert new row and/or column in a worksheet, To delete a row and/or column in a worksheet.

Power point

To familiarize with parts of PowerPoint, window create and save a new presentation, To apply design templates to a presentation insert, edit and delete a slide, To use different views of slides. To use slide show from beginning or from the current slide and To preview and print a presentation.

To check spellings in a presentation, To add clip art and pictures in a slide, To add chart, diagram and table in a slide, To set animation for a selected slide and/or for entire presentation.

II. Exploring the Internet:

To understand the working of the internet web browsers, create email-account, sending mails, receiving mails, sending files as attachments, etc. To login to a remote computer, To search information using search engines.

S.No.	Name/Title	Author	Publisher
1	Computer Organization fifth edition	Carl Hmacher	Mc Graw Hill



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2022 onwards

Medical Mycology

Course Code	MMB601	
Course Title	Medical Mycology	
Type of course	CC	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	 The aim of this course is to enable the students to: Provide insights into pathogenicity and prophylaxis of various kinds of fungal infections. Demonstrate methods of lab diagnosis of common fungal agents mentioned in the syllabus 	
Course Outcomes	At the conclusion of the course, the students will: 1. Explain classification, morphology and laboratory diagnosis and prevention measure of fungi 2. Differentiate between superficial, subcutaneous, systemic and opportunistic mycosis. 3. Identification and description of mycosis.	

UNIT-I

Introduction to medical mycology: Taxonomy, classification and general characteristics of various medically important fungi, Normal fungal flora, Morphological, cultural characteristics of common fungal laboratory contaminants

UNIT-II

Laboratory diagnosis: Direct microscopy in Medical mycology laboratory, Culture media used in mycology chemotherapeutic agents for fungi, mechanism of resistance of chemotherapeutic agents,

Molecular techniques: Recent molecular techniques used for the diagnosis of fungal infection.

UNIT-III

Superficial mycoses: Pathogenicity, clinical features and laboratory diagnosis of Dermatophytoses, Piedra, Tinea nigra, Tinea versicolor.

Subcutaneous mycoses: Pathogenicity, clinical features and laboratory diagnosis of *Mycetoma*, *Chromoblastomycosis*, *Sporotrichosis and Rhinosporidiosis*

UNIT-IV

Superficial mycoses: Pathogenicity, clinical features and laboratory diagnosis of *Paracoccidioidomycosis*, *Coccidiodomycosis*, *Histoplasmosis*, *Blastomycosis*.

Opportunistic mycoses: Pathogenicity, clinical features and laboratory diagnosis of Cryptococcosi, Candidiasis, Aspergillosis, Penicillosis, Zygomycosis.

S.No.	Name/Title	Author	Publisher
1	A Guide to Study of Basic Medical	Kee Peng Ng et al.	Kindle Edition
	Mycology		
2	Medical Mycology: A Self Instructional	Kathleen S. Blevins	F.A. Davis Company
	Text		
3	Fundamental Medical Mycology	Errol Reiss et al.	Wiley-Blackwell
			·

Medical Virology

Course Code	MMB605	
Course Title	Medical virology	
Type of course	CC	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Provide in-depth knowledge about pathogenicity and prophylaxis of viral infections 2. Demonstrate the laboratory diagnosis of common viral infections	
Course Outcomes	At the conclusion of the course, the students will: 1. Explain classification, nomenclature, structure and properties of viruses 2. Apply this knowledge to understand the cultivation, isolation, transmission mode of infection of various viruses 3. Analyze the role of molecular techniques to identify diseases and laboratory diagnosis and prophylaxis	

UNIT- I

General Properties of Viruses: Origin of virology, properties of viruses, classification and nomenclature of viruses, structure of viruses, capsid symmetry and architecture.

UNIT- II

DNA & RNA viruses: Transmission of viruses, epidemiology of viral infection, prevention and control measures of viral infection, molecular techniques for clinical diagnosis of viral diseases.

UNIT-III

Cultivation and Purification of Viruses: Cultivation, isolation, purification and virus assays, virus receptors, interaction with host cell, attachment and penetration, uncoating and replication, lysogenic and lytic bacteriophages, lysogeny with special reference to lambda and mu phages

UNIT- IV

Pathogenicity, clinical features, laboratory diagnosis, immunoprophylaxis and prophylaxis: Dengue, Yellow fever, Influenza virus(H5N1 & H1N1), Rubella virus, Hepatitis, HIV, Ebola, Nipah and Corona Virus

S.No.	Name/Title	Author	Publisher
1	Medical Virology	D.E White & Frank J. Fenner	Elsevier
2	Principles of Virology	F.J Flint et al.	ASM Press, Washington DC
3	Medical Virology: A practical Approach	U. Desselberger	Oxford University Press

Immunology

Course Code	MMB609	
Course Title	Immunology	
Type of course	CC	
LTP	4 0 0	
Credits	4	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Learn the basics of immunology including structural components, their functions and underlying mechanisms. 2. Provide in-depth knowledge about the molecular mechanisms underlying the various immunological processes.	
Course Outcomes	At the conclusion of the course students will: 1. To provide students a conceptual knowledge of immunological processes. 2. To understand the mechanism of how the immune system works. 3. Be able to provide an overview of the interaction between the immune system and pathogens.	

IINIT-I

History of immunology, Immune response: mechanism of innate and adaptive immune response. Structure, composition and types of cells involve in immune response: mononuclear cells, granulocytes, antigen presenting cells, lymphoid cells. Mediators and process of inflammation

Structure and function of immune system: primary and secondary lympboid organs Antigens- structure and properties, factors affecting the immunogenicity, haptens, superantigen, adjuvants

UNIT-II

Antibody: structure, properties, types and function of antibodies, antigenic determinants on immunoglobulin; isotypes, allotypes, and idiotypes.

Development of humoral immunity, Cell mediated immunity and its mechanism

Vaccines: Active and passive immunization, Types of vaccine: whole organism vaccine, sub unit vaccine, DNA vaccine, recombinant vaccine, subunit vaccines and anti-idio type vaccine

UNIT-III

Major histocompatibility complex: organization of MHC genes, types and function of MHC molecules, antigen presentation.

Complement system: components, activation pathways, regulation of activation pathways and role of complement system in immune response.

Cytokines: types, structure and functions, cytokines receptors, cytokine regulation of immunereceptors.

UNIT-IV

Hypersensitivity: type I, II, III and types IV hypersensitivity. Immunodeficiency diseases: primary and secondary immunodeficiency.

Autoimmunity: organ specific autoimmune diseases

Transplantation immunologic basis of graft rejection, clinical manifestation of graft rejection and clinical transplantation.

S. No	Name	Author(S)	Publisher
	Immunology, 5 th edition	Janis Kuby	W.H.Freeman & Co Ltd; 3rd
1			Revised edition edition (16 April 1997)
2.	Essential Immunology, 9 th Edn.	Ivan M. Roitt	Blackwell Science, Inc.
3.	Handbook of Human Immunology,	Mary S. Leffell,& Noel R. Rose,	CRC Press

Recombinant DNA Technology (RDT)

Course Code	MMB613	
Course Title	Recombinant DNA Technology (RDT)	
Type of course	DSE	
LTP	3 0 0	
Credits	3	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Understand the basics of restriction endo-nucleases and cloning vectors 2. Apply the cloning strategy to develop novel microbial strains.	
Course Outcomes	At the conclusion of the course, the students will: 1. The students will be able to understand the basics of recombinant DNA technology 2. Able to identify the different DNA modifying enzymes and understand their roles in microbial technology 3. Able to acquire knowledge of different cloning vectors; cloning techniques and utilize them to produce pharmaceutical products for treatment of microbial infections	

UNIT-I

Enzymes used in DNA technology: Restriction Endonucleases and Restriction mapping, DNA modifying enzymes- Nuclease, Polymerase, Enzymes that modify the ends of DNA molecules. DNA ligase-joining DNA Molecules, Use of adaptors, Linkers, Homopolymer tailing.

UNIT-II

Gene cloning vectors: Plasmids, Cosmids, Bacteriophage (bacteriophage lambda and M13 based vectors), Phagemids, BAC, YAC, Shuttle vectors, Ti plasmid based vectors, animal vectors.

Cloning techniques: DNA isolation (Bacteria, Fungi, Plant and animal), Insert preparation, Ligation, Transformation methods (chemical methods, Electroporation and microinjection), Transfection

UNIT-III

Cloning Strategies: Construction of Genomic libraries, cDNA libraries, Preparation of DNA fragments for cloning: Positional cloning, chromosome walking

Selection of Recombinants: Selection, screening and analysis of recombinants by genetic, immunological and nucleic acid hybridization methods

UNIT-IV

Applications of Recombinant DNA Technology in Medicine, Molecular diagnostics, Recombinant and DNA vaccines. Gene therapy- somatic and germ line gene therapy.

Polymerase Chain Reaction: qPCR, Electrophoresis & Blotting Techniques, Site-Directed Mutagenesis, DNA Sequencing, DNA Fingerprinting

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S.No.	Name/Title	Author	Publisher
1	Cell and Molecular Biology: Concepts and Experiments. 6th edition.	Karp, G.	John Wiley & Sons. Inc.
2	The Cell: A Molecular Approach. 5th Edition	Cooper, G.M. and Hausman, R.E.	The Cell: A Molecular Approach. 5th Edition
3	Molecular Cell Biology 6th edition.	Lodish, H., Berk	W. H. Freeman
4	Gene Cloning and DNA Analysis	T A Brown	Blackwell
5	From Genes to Genomes: Concepts and Applications of DNA Technology, 3rd Ed.	Jeremy W. Dale, Malcolm von Schantz, Nicholas Plant	Wiley
6	From genes to clones: Introduction to gene technology	by Ernst L. Winnacker	John Wiley

Applications of Microbiology

Course Code	MMB619		
Course Title	Applications of Microbiology		
Type of Course	DSE		
LTP	300		
Credits	3		
Course Prerequisites	DSE		
Course Objectives (CO)	 The aim of this course is to enable the students to: Develop understanding about the basic process of fermentation and reactor design And their applications to the various fields viz: industry, agriculture and environment. 		
Course Outcomes	 At the conclusion of the course students will: Have the basic knowledge and understanding of fermentation processes, design of fermentors and their types. Comprehensive knowledge of separation techniques and application of fermentation in waste treatment. Will also learn the economics of fermentation for the total cost of production. Able to apply their knowledge and understanding of microbes for the sustainability of agriculture and environment. 		

UNIT - I

Fermentation: Introduction, isolation, screening and selection of industrially important microorganisms, Media used: molasses, cornsteep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates,

SBBSD

Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (eg. baker's yeast) and continuous fermentations.

UNIT -II

Bioreactors: Design and components of basic fermentor, specialized fermentors for specific purposes – continuous, anaerobic, for gaseous nutrients, for treatment of wastes, trickle flow reactors, cyclone reactors, submerged types, tube reactors, packed bed reactors, lab scale to pilot to industrial – scale up process, online monitoring.

UNIT-III

Bioprocessing – Downstream processing of industrial fermentation processes, product purification and recovery, Physicochemical basis of bio-separation processes, techniques for purification of end products – chromatography, electrophoresis, distillation, crystallization, filtration. Economics of a fermentation process, determination of cost and its recovery, cost cutting strategies, cell and enzyme immobilization, biological waste treatment, hygiene and safety in fermentation industries

UNIT-IV

Microbes in environment – Role and diversity, technique to study them, Solid and Liquid waste Treatment of sewage and industrial effluents, Secondary waste treatment – aerobic, anaerobic and Composting.

Role of Microbes in Agriculture – bioinoculants, biodegradation and bioremediation of xenobiotic compounds, technique of bioremediation using microbes, Bioleaching of Metals, Biofuels, Microbes as food, Bioplastics, GEMs – Application and hazards.

S. No.	Name/Title	Author	Publisher
1	Text book of Microbiology	Ananthanarayanan & Paniker	Universities press pvt. Ltd
2	Agricultural Microbiology	ICAR	Agrimoon.com

Medical Anatomy & Physiology-II

Course Code	MMB621
Course Title	Medical Anatomy & Physiology-II
Type of course	DSE
LTP	3 0 0
Credits	3
Course prerequisite	10+2 Medical/ Dip in MLT/ Non-Med with 50% marks.
Course Objective	 The aim of this course is to enable the students to: Impart knowledge and understanding of structure of human organs systems and their role in coordination and integrated functions of human body. Have in-depth understanding of anatomy & physiology of Digestive, Excretory and reproductive system
Course Outcomes	At the conclusion of the course, the students will be: 1. Able to explain the anatomy, physiology and functions of various organs mentioned in their course 2. Able to describe the role of these organ systems in maintenance of healthy. 3. Apply concepts and knowledge of terminology related to the Digestive, Excretory, Endocrine and Integumentary within and between various systems of human body

UNIT-I

Digestive system: Parts of digestive system, gross anatomy and functions.

Gastrointestinal Tract: Functional Anatomy, Salivary glands (secretion and functions of saliva, deglutition), Stomach (composition, regulation of secretion and functions of the gastric juice), Liver (secretion and functions of bile), Pancreas (secretion and function), Intestinal secretion (composition and functions).

Excretory system: Parts of excretory system, gross anatomy of kidney, ureter, urinary bladder, and their functions. Functions of kidney, Juxta glomerular apparatus, Formation of urine, counter current mechanism, Role of kidney in maintenance of acid base balance, Renal function tests.

UNIT-III

Reproductive system: Male reproduction system- gross anatomy of penis, testis, epididymis, vas-deferens, seminal vesicles and prostate. Female reproductive system- gross anatomy of ovaries, uterine tube, uterus, vagina, menstruation cycle

UNIT-IV

Endocrine system: Classification, Hormones produced, Control of hormone secretion, basic functions

Integumentary system: Thick Skin, Thin skin, layers of dermis & epidermis, Skin appendages, blood supply, innervations, functions

Text and Reference Books

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Text a	Text and Reference Books				
S. No	Name	Author(S)	Publisher		
1.	Anatomy & Physiology- Ross and	Anne Waugh & Allison	Churchill Living Stone		
	Wilson	Grant			
2	Anatomy and Physiology:	Robert Clark	Jones & Bartlett publishers		
	Understanding the Human Body				
3	Anatomy and Physiology for nurses	Evelyn Pearce	Faber & Faber		
4.	Functional Histology	James S. lowe, Barbara	Elsevier		
		young, Allen Stevens & John			
		W heath			
5.	Text book of human Histology with	Inderjit singh	Jaypee Brothers Medical		
	color Atlas and Practical Guide		publishers		
6.	Understanding Human Anatomy and	Willium Davis	Mc Graw Hill		
	Physiology				

Bioinformatics

Course Code	MMB623
Course Title	Bioinformatics
Type of course	SECC
LTP	2 0 0
Credits	2
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.
Course Objective	 The aim of this course is to enable the students to: Gain knowledge about common bioinformatic tools and databases. Learn the practical skills in retrieval of DNA sequences and Protein sequences from databases.
Course Outcomes	At the conclusion of the course, the students will 1. Acquire basic knowledge regarding bioinformatics and its role in molecular data analysis 2. Acquire knowledge about sequence alignment and analysis.

UNIT-I

Introduction: Introduction to Bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases (GENBANK, PubMed, PDB) and software (PHYLIP)

UNIT-II

Sequence Alignments and Phylogeny: Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment and multiple sequence alignment (Clustal W algorithm), Introduction to phylogenetics.

UNIT III

Structural Bioinformatics: Properties of amino acids and peptide bonds, Ramachandran Plot. Motifs and Folds; Protein structure related databases,

Protein Fold Classification, Protein structure comparison, CATH and SCOP Databases

UNIT IV

Data generation: Gene Sequencing, Protein sequencing, 2 D Gel electrophoresis, Microarray.

S.No.	Name/Title	Author	Publisher
1	Bioinformatics: Principles and Applications	Zhumur Ghosh, Bibekanand Mallick	Oxford

Medical Diagnostics

Course Code	MMB625	
Course Title	Medical Diagnostics	
Type of Course	SECC	
LTP	200	
Credits	2	
Course Prerequisites	M.Sc. Medical Microbiology as Ability Enhancement course	
Course Objectives (CO)	 The aim of this course is to enable the students to: Impart knowledge of basic diagnostic procedures for the analysis of biological fluids viz. blood and urine. Gain knowledge about the basic imaging technologies pertaining to the malfunctioning of cells and tissues. 	
Course Outcomes	 At the conclusion of the course students will: The students will be able to learn how to collect, preserve process and analyze the biological samples for disease diagnosis. Able to explain test related to diagnosis of infectious diseases: Tuberculosis and Hepatitis Gain understanding of medical imaging technologies needed for detection of bone fractures, deformities and malignancies 	

UNIT- I

Introduction to Medical Diagnostics and its Importance

Diagnostics Methods Used for Analysis of Blood: Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

UNIT-II

Diagnostic Methods Used for Urine Analysis: Urine Analysis: Physical characteristics; Abnormal constituents of urine.

UNIT-III

Non-infectious Diseases: Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit

UNIT-IV

Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Tumors: Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT scan (using photographs).

S.No.	Name/Title	Author	Publisher
1	Preventive and Social Medicine	Park, K.	B.B. Publishers
2	Textbook of Medical Laboratory Technology, II Edition	Godkar P.B. and Godkar D.P	Bhalani Publishing House
3	Pathologic Basis of Disease, VIIIEdition	Robbins and Cortan	Saunders

Research Methodology

Course Code	MMB615	
Course Title	Research Methodology	
Type of Course	AECC	
LTP	200	
Credits	2	
Course Prerequisites	M.Sc. Medical Microbiology as Ability Enhancement course	
Course Objectives (CO)	The aim of this course is to enable the students to: 1. Understand the basic principles, types and importance of research designs 2. Apply methods to draw inferences from the research findings.	
Course Outcomes	At the conclusion of the course students will: 1. Able to learn how to collect, read and manage research information. 2. Able to plan experiments, conduct and observe results. 3. Able to write and publish results effectively.	

UNIT -I

Objectives and Types of Research: Motivation and objectives – research methods vs. Methodology. Types of research – Descriptive vs. Analytical, applied vs. Fundamental, Quantitative vs. Qualitative, and Conceptual vs. Empirical

UNIT-II

Research Formulation: Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem - Literature review - Primary and secondary sources

UNIT-III

Research Design and Methods: Research design, Basic Principles, Need of research design, Observation and Facts.

UNIT-IV

Reporting and Thesis Writing – Structure and components of scientific reports, Types of report, Technical reports and thesis – Significance – Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes

S. No	Name	Author(S)	Publisher
1	An introduction to Research Methodology	Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K.	RBSA Publishers
2	Research Methodology: Methods & Techniques	Kothari.C.R	New Age International

Medical Mycology Practical

Course Code	MMB603	
Course Title	Medical Mycology (Practical)	
Type of course	CC	
LTP	0 0 4	
Credits	2	
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.	
Course Objective	The aim of this course is to enable the students to: 1. Impart hands on practice to culture, isolate and identify common fungal infections 2. Gain practical knowledge about maintenance of fungal stock cultures.	
Course Outcomes	At the conclusion of the course students will be able: 1. To collect clinical specimen of fungal infection 2. To perform laboratory investigations for the diagnosis of infectious diseases caused by fungi 3. To maintain stock cultures	

LIST OF PRACTICALS

- 1. Collection of specimens for mycology.
- 2. Direct examination of specimens by KOH, Gram, Kinyoun's, Giemsa, Lactophenol cotton blue stains.
- 3. Isolation and identification of pathogenic yeasts and moulds and recognition of common laboratory contaminants.
- 4. Special techniques like Wood's lamp examination, hair baiting, hair perforation, paraffin baiting and slide culture.
- 5. Maintenance of stock cultures.

S. No	Name	Author(S)	Publisher
1.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan	Tata McGraw Hill
		& Noel R. Krieg	
2	Text book of Microbiology	Ananthanereyan And Paniker's	Universities Press
		Text Book of Micrbiology	
3.	Medical Microbiology	Paniker &Satish Gupte	Universities Press

Medical Virology Practical

Course Code	MMB607		
Course Title	Medical Virology (Practical)		
Type of course	CC		
LTP	0 0 2		
Credits	1		
Course prerequisite	B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science & Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.		
Course Objective	The aim of this course is to enable the students to: 1. Learn basic procedures related to sterilization and media preparation for viral infected cultures 2. Demonstration of serological tests as mentioned in syllabus.		
Course Outcomes	At the conclusion of the course, the students will: 1. Perform blood samples for the diagnosis of viruses through serological tests. 2. Preparation of different type of media for the cultivation of viruses 3. Demonstrate handling of animals for pathogenicity tests.		

LIST OF PRACTICALS

- 1. Preparation of glassware for tissue culture (washing, sterilization)
- 2. Preparation of media like Hanks, MEM.
- 3. Preparation of clinical specimens for isolation of viruses.
- 4. Serological tests
- ELISA and rapid tests for HIV
- RPHA for HbsAg
- Haemagglutination inhibition for influenza
- AGD and couterimmunelectrophoresis for detection of viral antigens or antiviral antibodies.
 - 5. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

Note: wherever wet lab experiments are not possible the principle and concepts can be demonstrated through any other medium or material including videos or may be performed in the premises of MOU signed hospitals

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S. No	Name	Author(S)	Publisher
1.	Text book of Microbiology	Michael J. Pelczar, JR. E.C.S Chan	Tata McGraw Hill
		& Noel R. Krieg	
2	Text book of Microbiology	Ananthanarayan And Paniker's	Universities Press
		Text Book of Micrbiology	
3.	Medical Microbiology	Paniker & Satish Gupte	Universities Press

Immunology Practical

MMB611		
Immunology Practical		
CC		
0 0 4		
2		
B.Sc. MLT or B.Sc. (Medical/Applied Medical Science/Biosciences/Medical Science		
& Allied Medical/Life Sciences) with 50% aggregate marks or it is equivalent.		
The aim of this course is to enable the students to:		
1. Have hands on practice to perform various laboratory procedures in the field		
of immunology		
2. Learn the principle and technique to study antigen antibody interaction		
At the conclusion of the course, the students will:		
1. Able to understand the basic laboratory practices in the field of immunology		
2. Determination of TLC, DLC, ABO & Rh factor from blood sample		
3. Demonstration of antigen / antibody determination by various techniques		

LIST OF PRACTICALS

- 1. To prepare serum and plasma from blood.
- 2. To precipitate immunoglobulins by ammonium sulphate and to determine total protein contents.
- 3. To determine Blood group and Rh factor by slide agglutination test
- 4. To determine Total Leukocyte Count (TLC) for given blood sample
- 5. To determine Differential Leukocyte Count (DLC) for given blood sample using Leishman stain.
- 6. To perform Widal agglutination test (slide and tube) for diagnosis of typhoid.
- 7. To perform Dengue test.
- 8. To perform Ouchterlony double diffusion test for detection of anti.gen and antibody reaction and to demonstrate relationship between antigens.
- 9. To perform Radial immuno-diffusion test for detection of antigen and antibody reaction and for quantification of antigens.
- 10. Demonstration of antigen / antibody determination by Immunoflourescence, CCIEP, ELISA.

Note: wherever wet lab experiments are not possible the principle and concepts can be demonstrated through any other medium or material including videos or may be performed in the premises of MOU signed hospitals

S. No.	Author(s)	Title	Publisher
1	Frances Fischbach	A Manual of Laboratory & Diagnostic Tests	Lippin Cott wiliam & wilkins

Seminar

Course Code	MMB617
Course Title	Seminar
Type of course	CC
LTP	0 0 2
Credits	1
Course prerequisite	M.Sc Medical Microbiology as Skill Enhancement Course
Course Objective (CO)	The aim of this course is to enable the students to:
	 Prepared presentation to impart skills or knowledge.
	Develop and evaluate test systems and interpretive algorithms.
Course Outcome	At the conclusion of the course students will:
	Understand the application of computer.
	2. Develop critical thinking, interdisciplinary enquiry
	3. Develop presentation skills.

Every student shall deliver at least one seminar on topic of the curriculum/ advances in Microbiology which will individually be assessed by every available teacher on the basis criteria laid down by the Staff council. Students in audience will also been courage to assess the seminar on the given criteria and their evaluation will also be given due consideration.



FOURTH SEMESTER

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Dissertation/Project

Course Code	MMB602
Course Title	Dissertation/Project
Type of course	CC
LTP	0 0 26
Credits	26
Course prerequisite	B.Sc MLT/MLS/ Medicine/ Applied Medical Science/ Bio- Science/ Medical Science Allied Medical Science/ Life Science/Microbiology/Biochemistry.
Course Objective (CO)	 The aim of this course is to enable the students to: 1. Provide medical microbiological services at various levels viz: Hospitals, Laboratories, Industries, Academics and R& D sectors. 2. Manage information to enable effective, timely, accurate and cost-effective reporting of laboratory results.
Course Outcome	At the conclusion of the course students will: 1. Understand the research methodology and techniques of experimental work. 2. Develop skill of scientific writing. 3. Impart proficiency of designing scientific experiments and carry out those experiments.

GUIDELINE TO CARRY OUT PROJECT WORK

- 1. Purpose of Project Work: The main purpose of Project Work is to make the students familiar with Research Methodology i.e. reference work, experimental work, statistical analysis of experimental data, interpretation of results obtained, writing of dissertation and power point presentation of Project work. This will not only help train the inquisitive minds of the students, but also inspire them to take up research- oriented higher studies and career.
- 2. **Duration of Project work:** Development on the nature of the research problem and the infrastructure available in the Respective Biotechnology/Biochemistry/Microbiology Departments or Research Institutes or Industries, the recommended duration of Project Work is 05 months which includes 4 months of training and 2 months for dissertation compilation.
- 3. Nature of Research Project: The following will be considered as the Research Project.
 - a) Experimental based involving laboratory analytical work, or
 - b) Survey based Field work with statistical analysis of data collected, or
 - c) Industrial training based provided that the candidate has undergone actual hands on training in instrumental analytical techniques.
- 4. Submission of project Work:
 - a) After completion of Project each student should prepare a PowerPoint presentation to be delivered to the respective department committee.
 - b) The committee should conduct comprehensive viva-voce of the students.
 - c) The final copy of the dissertation will have to submit to the respective department.