

SCHEME & SYLLABUS
M.Sc.-Medical Laboratory Science
(CLINICAL MICROBIOLOGY)
PG032



Department of Life Sciences and Allied Health Sciences
UISH
SANT BABA BHAG SINGH UNIVERSITY
2020

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, Animal 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 bridges 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.

M.Sc. Medical Laboratory Sciences (Clinical 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 Laboratory Science (Clinical Biochemistry) and M.Sc-Medical Laboratory Science (Clinical Microbiology).

VISION

The Clinical Laboratory Sciences program at Sant Baba Bhag University will provide career – oriented laboratory education to an increasing number of qualified students. We will provide pedagogic, laboratory, and internship experiences that prepare students to succeed after post graduation

MISSION

The mission of the Master in Medical Laboratory Science (Biochemistry) program is to prepare candidates with the knowledge, skills, and professional behaviors needed to function effectively in biochemistry laboratory settings.

ELIGIBILITY CRITERIA

B.ScMLT/MLS/Medicine/ Applied Medical Science/ Bio- Science/ Medical Science Allied Medical Science/ Life Science/Microbiology/Biochemistry.

DURATION

2 Years

CAREER PATHWAYS

The program is designed to meet the growing requirement of qualified professionals in field of IT industry and education: The Medical Laboratory Technologists/ technician may be assigned to a specialized area of work in a large medical lab. In small labs, they may perform a variety of tests or all areas of lab work. 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 proficiently supervise and perform full range of clinical Microbiology laboratory tests.

PEO2. To develop and evaluate test systems and interpretive algorithms.

PEO3. To enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information

PEO4. To provide the student with the cognitive and psychomotor competencies to meet the entry requirements for the profession of medical laboratory science.

PROGRAMME OUTCOMES (PO)

PO1. Apply the knowledge and skills appropriate to discipline for the advanced research.

PO2. Develop competency to think creatively, critically and objectively with core and inter-disciplinary excellence.

PO3. Have collaborative and multidisciplinary skills to work as an effective member or leader to achieve goals.

PO4. Be the government medical laboratory professionals, scientists, and mentors of the future.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1. Students will be able to supervise/perform routine Clinical Microbiology laboratory testing.

PSO2. Students will be able to provide Medical laboratory services in all types of clinical laboratories from Primary healthcare laboratory to Tertiary health care institution in the fields of Systematic Bacteriology, Immunology, Medical Mycology, Parasitology and Medical Virology.

PSO3. Students will be able to make specimen-oriented decision on predetermined criteria including working knowledge of critical values.

PSO4. Students will be able to communicate with other members of healthcare team, customers and patients in an effective manner, understand and demonstrate safe laboratory practices.

PSO4. Students will be able to process information and ensure quality control as appropriate to routine laboratory.

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Course Scheme
M. Sc. MLS Clinical 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
1	CMB501	Basic Medical Microbiology	4:0:0	4:0:0	4	4
2	CMB505	Systematic Bacteriology	4:0:0	4:0:0	4	4
3	CMB507	Intellectual Property Right	2:0:0	2:0:0	2	2
4	CMB509	Human Anatomy & Physiology	4:0:0	4:0:0	4	4
5	MAT515	Biostatistical Methods	3:0:0	3:0:0	3	3

II. Practical Subjects

1	CMB503	Basic Medical Microbiology (Practical)	0:0:4	0:0:2	4	2
2	CMB511	Human Anatomy & Physiology(Practical)	0:0:4	0:0:2	4	2
3	CMB513	Systematic Bacteriology (Practical)	0:0:4	0:0:2	4	2
Total					29	23

Total Contact hrs: 29

Total Credit Hours: 23

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
1	CMB502	Concept of Hematology & Blood Banking	4:0:0	4:0:0	4	4
2	CMB506	Applied Bacteriology	4:0:0	4:0:0	4	4
3	CMB510	Clinical Parasitology	4:0:0	4:0:0	4	4
4	CMB514	Clinical Biochemistry	3:0:0	3:0:0	3	3
5	CSE554	Introductory Concepts of Computer Technology	3:0:0	3:0:0	3	3
6.	EVS003	Natural Hazards & Disaster Management	3:0:0	3:0:0	3	3

II. Practical Subjects

1	CMB504	Concept of Hematology & Blood Banking (Practical)	0:0:2	0:0:1	2	1
2	CMB508	Applied Bacteriology (Practical)	0:0:2	0:0:1	2	1
3	CMB512	Clinical Parasitology (Practical)	0:0:2	0:0:1	2	1
4	CMB516	Clinical Biochemistry (Practical)	0:0:2	0:0:1	2	1
5	CSE556	Introductory Concepts of Computer Technology (Practical)	0:0:2	0:0:1	2	1
Total					31	26

Total Contact hrs: 31
Total Credit Hours: 26

SEMESTER III

1.Theory Subjects

S. No	Sub Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credits Hours
1	CMB601	Medical Mycology	3:0:0	3:0:0	3	3
2	CMB605	Medical Virology	3:0:0	3:0:0	3	3
3	CMB609	Recombinant DNA Technology (RDT)	3:0:0	3:0:0	3	3
4	CMB611	Molecular Biology and Bioinformatics	3:1:0	3:1:0	4	4
5	CMB613	Medical Laboratory Management	3:1:0	3:1:0	4	4

II. Practical Subjects

1	CMB603	Medical Mycology (Practical)	0:0:3	0:0:1.5	3	1.5
2	CMB607	Medical Virology (Practical)	0:0:3	0:0:1.5	3	1.5
3	CMB615	Seminar	0:0:2	0:0:1	2	1
Total					25	21

Total Contact hrs:25

Total Credit Hours: 21

SEMESTER-IV

Dissertation/Project

S. No	Sub Code	Subject Name	Total Contact Hours	Total Credits Hours
1	CMB602	Dissertation/Project	26	26

Contact Hours*: Submission within five Months

Total Contact hrs:512
Total Credit Hours: 26

COURSE SCHEME SUMMARY

Semester	L	T	P	Contact hrs/wk	Credits
1	17	0	12	29	23
2	21	0	10	31	26
3	15	2	8	25	21
4	0	0	26	26	26
Total	53	2	56	111	96

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

Total Contact hrs for I-III semester: 85
Total Credit Hours for I-III semester: 70

Total Contact hrs for IV semester: 512 (Five Months)
Total Credit Hours for IV semester: 26

*First
Semester*

Basic of Medical Microbiology

Course Code	CMB501
Course Title	Basic of Medical Microbiology
Type of course	Theory
L T P	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	To make the students competent to isolate and identify the causative micro-organisms.
Course Outcomes	The students will able to : 1. To give a comprehensive overview and understanding of the biological principles in relation to microbial structure, physiology, biochemistry and genetics: growth and control of micro organisms 2. Use of standard safety measures while handling infective materials.

UNIT-I

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

Microscopy: Principle, methods of safe working, different parts, preparation of smears for examination, applications of following microscopes Bright field, dark ground, phase contrast, differential interference contrast, fluorescent, electron- scanning (SEM), transmission (TEM), polarizing, tunneling.

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 Sporocidal agents Mycobacterial disinfection Quality control in sterilization

Principles in Clinical Microbiology: Collection, processing and handling of various samples, identification and characterization of micro organism, Laboratory safety, Quality control.

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

Cultivation of microorganisms: bacteriological examination of air, water, food and milk

UNIT-IV

Chemotherapeutic agents: general characteristics of antimicrobial drugs, determining the level of antimicrobial activity, origin, mechanism and transmission of drug resistance

Nosocomial infections: Introduction and its types, sources and mode of transmission of nosocomial infection, laboratory diagnosis of nosocomial infection, hospital infection control committee and their roles, prevention and control of nosocomial infections

Text and Reference Books:

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

Basic of Medical Microbiology - Practical

Course Code	CMB503
Course Title	Basic of Medical Microbiology – Practical
Type of course	Practical
L T P	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	To inculcate the knowledge of different processing and identification of various pathogens like bacteria, parasites, viruses using different techniques.
Course Outcomes	The students will able to: 1. isolate and identify the causative micro-organisms. 2. training in the use of standard safety measures while handling infective materials.

LIST OF PRACTICALS

Simple and Gram staining of bacteria

- To perform simple staining and Gram staining of bacterial cultures

Special stain

- To perform endospore staining and Albert's staining of bacterial culture

Physiological tests of bacteria

- To perform IMViC test
- To perform Urease, Oxidase and Catalase test

Effect of nutritional factors on growth

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

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

Microbes in hospital environment

- To isolate and identify the bacteria and fungi from hospital environment.

Systemic Bacteriology

Course Code	CMB505
Course Title	Systemic Bacteriology
Type of course	Theory
L T P	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	To enable the students about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria.
Course Outcomes	The students will be able to: <ol style="list-style-type: none"> 1. Learn the morphology cultural characteristics, biochemical characteristics of various bacteria 2. Study the various laboratory diagnosis of various bacteria.

UNIT I

Gram positive cocci: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of *Staphylococcus*, *Streptococcus*, *Pneumococcus*

Gram positive bacilli: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of *Corynebacterium*, *Bacillus*, *Clostridium* Acid fast bacteria

UNIT II

Gram negative cocci: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of *Mycobacterium tuberculosis*, *Neisseria*.

Gram negative bacilli: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of *Pseudomonas aeruginosa*, *Vibrio*, *Haemophilus influenzae*, *Campylobacter jejuni*

UNIT III

Enterobacteriaceae-I: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Enterobacteriaceae like *E.Coli*, *Klebsiella*, *Shigella*, *Salmonella*

Enterobacteriaceae-II: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Enterobacteriaceae like *Proteus*, *Acinetobacter*, *Enterobacter*, *Citrobacter*

UNIT IV

Miscellaneous bacteria-I: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of *Mycoplasma*, *Rickettsia*, *Chlamydiae*, *Ehrlichia*

Miscellaneous bacteria-II: detailed account of cultural & morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of *Actinomycetes* (*Actinomyces*, *Nocardia*), *Brucella*, *Listeria monocytogenes*, *Spirochaetes*

Text and Reference Books:

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.

Intellectual Property Right

Course Code	CMB507
Course Title	Intellectual Property Right
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	M. Sc. MLS (Clinical Microbiology) as Skill Enhancement Course
Course Objective	To inculcate the knowledge of intellectual property right to students and also aware them about Patents, trademark, copyright etc.
Course Outcomes	The students will able to: <ol style="list-style-type: none"> 1. Get awareness of acquiring the patent and copyright for their innovative works. 2. Recognize the crucial role of IP in organizations of different industrial 3. Demonstrate a capacity to identify, apply and assess ownership rights and marketing protection.

UNIT- I

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).

UNIT- II

Patents: Objectives, Rights, Patent Act 1970 and its amendments. Procedure of obtaining patents, Working of patents. 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, Defences, Domain name.

Industrial Designs: Objectives, Rights, Assignments, Infringements, Defences 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.

Text & Readings Book

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).

HUMAN ANATOMY AND PHYSIOLOGY

Course Code	CMB509
Course Title	Human Anatomy And Physiology
Type of course	Theory
L T P	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	Discuss about the interaction of different organ systems to maintain homeostatis.
Course Outcomes	Students will be able to: <ol style="list-style-type: none"> 1. Interpret the inter-dependency and interaction of the human body system. 2. Identify and explain the anatomical structure and the physiological functions of body system.

UNIT I

Introduction to anatomy and physiology: structural organization, homeostasis, regional and directional terms used in anatomy and physiology, body planes, body cavities and body regions

Cardiovascular system : composition of blood, structure and functions of heart and major blood vessels of the body, circulation of the blood, pulmonary circulation, systemic or general circulation, and portal circulation, conductive system of heart, cardiac cycle, ECG

UNIT II

Gastrointestinal system: structure & function of digestive system organs, digestive glands, digestive enzymes, mechanism of digestion of food in mouth, stomach and small intestine, gastrointestinal tract movements and absorption

Endocrine system: location, structure and functions of pituitary gland, thyroid gland, parathyroid glands, adrenal gland, hypothalamus, the pancreatic islets, pineal gland and thymus gland.

Respiratory System: structure and function of respiratory organs, mechanism of breathing and exchange of gases in the lungs, respiratory volume and capacities

UNIT III

Urinogenital system: structure and function of organs of urinary system, structure of nephron, mechanism of urine formation, micturition, structure and function of male and female reproductive systems, menstrual cycle, infertility and menopause, fertilization and embryogenesis.

Muscular system : structure of different types of muscles in human body, neuromuscular transmission and mechanism of muscle contraction

UNIT IV

Skeletal system: classification, structure and function of skeletal system, micro anatomical and gross structure of a bone, development and types of bones, various movement and types of joints

Nervous system: structure, function and location of brain and spinal cord, central nervous system, peripheral nervous system and autonomous nervous system, structure of neuron, synapse, conduction and transmission of nerve impulse

Text and Reference Books:

S.No.	Name/Title	Author	Publisher
1	Essentials of Medical Physiology	Sembulingam K. And Sembulingam P	Jaypee Brothers Medical Publishers Pvt. Ltd.
2	Principles Of Anatomy And Physiology (Volume - 1)	B. H., Tortora G.J. And Derrickson	Wiley

Human Anatomy & Physiology-II Lab

Course Code	CMB511
Course Title	Human Anatomy & Physiology-II Lab
Type of course	Practical
L T P	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 concepts related to anatomical details of human organ systems and integration and coordination between them will be demonstrated through charts, models and permanent slides.

LIST OF PRACTICALS

1. Study of following body systems showing all parts through charts and models
 - a) Excretory system: kidney, ureters and urinary bladder
 - b) Male reproductive system: Testes and vas deferens
 - c) Female reproductive system: ovaries, uterus, fallopian tubes
 - d) Nervous system: parts of brain; cerebellum, cerebrum, Pons and medulla oblongata

2. Study of histology of following tissues and organs from permanent slides:
 1. Kidney (LS)
 2. T.S of cortex part of kidney
 3. T.S of medulla part of kidney
 4. T.S of testes
 5. T.S of ovaries
 6. myelinated and non-myelinated nerve fibres
 7. T.S of spinal cord
 8. Thyroid gland (TS)
 9. Adrenal gland (TS)
 10. Pancreas (TS)

3. Study of structure of various sensory organs from charts.
 1. Eye
 2. Ear
 3. Nose

Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos

Systematic Bacteriology – Practical

Course Code	CMB513
Course Title	Systematic Bacteriology – Practical
Type of course	Practical
L T P	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	To enable the students about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria.
Course Outcomes	The students will able to: 1. Learn the morphology cultural characteristics, biochemical characteristics of various bacteria. 2. Study the various laboratory diagnosis of various bacteria.

LIST OF PRACTICALS

1. **Skin/pus pathogens:** Isolation and identification of Microbes from skin/pus
2. **Blood pathogens:** Isolation and identification of microorganisms from blood sample
3. **Pathogens in urine:** Isolation and identification of microorganisms from urine sample
4. **Upper respiratory tract:** Isolation and identification of microorganisms from throat
5. **Lower respiratory tract :** Isolation and identification of microorganisms from sputum sample
6. **Air-borne pathogens:** Bacteriological examination of pathogens present in air
7. **Wound pathogens :** To isolate and identify microorganisms of the wounds Microbial
8. **flora of the mouth :** To isolate and identify microbial flora of mouth teeth crevices
9. Isolation and identification of *Escherichia coli*
10. Isolation and identification of *Salmonella*

Biostatistical Methods

Course Code	MAT515
Course Title	Biostatistical Methods
Type of course	Theory
L T P	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	To give the knowledge of statistical techniques used in life sciences for simplification of complex things, so that they can be easily understood.
Course Outcomes	The students will: 1. 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 various business 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 Spearman's 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)

Text and Reference Books:

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	Affiliated East-West Press
4	Biostatistics	P. Ramakrishnan	Saras Publications
5	Biostatistics: Basic Concepts and Methodology for the Health Sciences	Wayne W. Daniel	Wiley Publication

Second Semester

Concept of Hematology & Blood Banking

Course Code	CMB502
Course Title	Concept of Hematology & Blood Banking
Type of course	Theory
L T P	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 (CO)	This subject aims to enable the students to carry out routine clinical laboratory investigation (blood, urine etc). He/she should be able to provide technical help for sophisticated hematological techniques with adequate knowledge of various principles.

UNIT-I

Introduction to hematology: Importance, laboratory organization and equipment used, safety measurements in hematology laboratory.

Hematopoiesis: Erythropoiesis, leucopoiesis, thrombopoiesis formation, function & morphology. Anticoagulants used in various haematological studies.

UNIT-II

Romanowsky stains:-Principle, procedure and preparation of stains.

Routine hematological tests: Principle, procedures, normal values and clinical significance:

- Determination of Haemoglobin
- Determination of Haematocrit
- Enumeration of RBC, WBC & Platelets
- Preparation of blood film
- Staining of blood film for morphology of red cells and Differential count

Immuno-hematology: Principles of immunohematology, Human blood group systems (basic genetics of ABO & Rh blood group systems).Methods of blood group typing

UNIT-III

Blood Coagulation: Theories of blood coagulation, Normal haemostatic mechanism, Classification of coagulation factors.

Haemostasis: Investigation of haemostatic mechanism: BT, CT, whole blood coagulation time test, PTT, Platelet function tests, Screening coagulation tests such as Bleeding and clotting Time, prothrombin time (PT) and Activated Partial Thromboplastin time (APTT).

Hematological Disorders: Classification and approach to diagnosis and diagnostic tests of Anemias, leukemias, Polycythemias chronic myeloproliferative disorders and other malignant disorders of the haemopoietic system.

UNIT-IV

Principle & Practices of Blood Transfusion: Principle & Practice of blood Transfusion, Guide lines for the use of Blood, Quality Assurance: Antilogous Blood Transfusion practices, Standard operating procedures for usage, donation & storage of blood, screening of donor.

Blood donation & Collection: Introduction, Blood donor requirements, Criteria for selection & rejection, Medical history & personal details, Self-exclusion. Health, Screening for TTI. Anticoagulants, Taking & giving sets in Blood transfusion, Techniques of collecting blood from a donor, Instructions given to the donor after blood donation, Adverse donor reaction., Storage of blood, Transportation.

Blood banking: Testing Donor Blood- Screening test and Compatibility Testing

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2	Medical laboratory Technology Volume-III (2 nd Ed.)	KL Mukherjee	Tata Mcgraw Hill
3.	Medical Laboratory Sciences, Theory & Practical	Arundhati Kolhatkar & J. ochei	Mcgraw Hill
4.	Basic Medical Laboratory Techniques	Barbara H. Estridge & Anna P. Reynolds	Delmer publishers

Concept of Hematology & Blood Banking Practical

Course Code	CMB504
Course Title	Concept of Hematology & Blood Banking Practical
Type of course	Theory
L T P	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 (CO)	To impart hands-on training for identifying blood cell abnormalities for the diagnosis of disease and to provide skills necessary to perform blood cell count and evaluation of blood elements within stated limits of accuracy

LIST OF PRACTICALS

LIST OF PRACTICALS

1. Venipuncture and collection of blood samples.
2. Preparation of blood smear and staining using Geimsa stain and Leishmann stain..
3. Deciding specimen types and selection of - Anticoagulant- EDTA, Citrate, Oxalate, Heparin, sodium fluoride.
4. RBC count, WBC count & Platelet count
5. Differential Leucocyte count
6. Calculation of Red Cell Indices
7. Estimation of Haemoglobin
8. Determination of ESR.
9. Sickling tests
10. Osmotic fragility test.
11. Preparation and demonstration of Lupus erythematosus (LE) cell
12. ABO grouping & Rh typing
13. Coombs test
14. Compatibility testing & cross matches
15. HBsAg & HIV antibody testing in blood bank

Note: Wherever wet lab experiments are not possible the principles and concepts can be demonstrated through any other material or medium including videos

Applied Bacteriology

Course Code	CMB506
Course Title	Applied Bacteriology
Type of course	Theory
L T P	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	To enable the students about the different types of diagnosis of bacterial pathogen in laboratory.
Course Outcomes	The part will cover the strategy in the Laboratory diagnosis of various infective syndromes i. e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogen and then to put antibiotic susceptibility testing. This will also cover Bacteriological examination of water, milk, food and air.

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

UNIT-IV

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 Lyophilisation methods

Epidemiological markers: Serotyping, Phage typing, Bacteriocin typing.

Text & Reference Books:

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

Applied Bacteriology (Practical)

Course Code	CMB 508
Course Title	Applied Bacteriology (Practical)
Type of course	Practical
L T P	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	To provide students' knowledge of the laboratory strategy in the diagnosis of various infective syndromes i.e. choice of samples, collection and transportation and processing of samples for isolation of bacterial pathogens and then to put antibiotic susceptibility testing.
Course Outcomes	The students will able to: 1. cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections 2. make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.

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:
 - a) Blood
 - b) Throat swab
 - c) Sputum
 - d) Pus
 - e) Urine
 - f) Stool for *Salmonella*, *Shigella* and *Vibrio cholera*
 - g) C.S.F. and other body fluids
4. Antimicrobial susceptibility testing
 - a) Introduction and terms used
 - b) Preparation and standardization of inoculum
 - c) To demonstrate reference bacterial strains
 - d) Choice of antibiotics
 - e) To determine MIC and MBC a known bacteria against a known antibiotic
5. To perform antibiotic susceptibility testing of clinical isolates by using
 - a) Stokes method and
 - b) Kirby-Bauer method

6. Collection, transportation and processing of following articles for bacteriological examination:

- e) water,
- f) milk
- g) food and
- h) air samples

7. To demonstrate sterility testing of intravenous fluid with positive and negative controls

8. Demonstration of serotyping and bacteriocin typing

9. Demonstration of lyophilization

10. To learn 'How to dispose of bacterial cultures'

Text- Books & Reference Books:

S. No.	Author(s)	Title	Publisher
1.	Mackie & Mac Cartney	Practical Medical Microbiology Volume 1 and Volume 2	Churchill Living Stone
2.	D.R Arora & B. Arora	Text book of Microbiology	CBS Publishers
3	KL Mukherjee	Medical laboratory Technology Volume-II	Tata McGraw Hill (2 nd Ed.)

Clinical Parasitology

Course Code	CMB510
Course Title	Clinical Parasitology
Type of course	Theory
L T P	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	To enable the students about the different types of Parasites & their diagnosis in laboratory.
Course Outcomes	<ol style="list-style-type: none"> 1. Understand the general characteristics and the disease caused by various protozoans and helminths. 2. Comprehend the techniques for diagnosis of parasites. 3. Learn the examination of stool and blood samples for diagnosis of disease. 4. Know the role of vector in spreading the parasitic diseases.

UNIT-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.

Stool examination: Gross examination of stool, microscopic examination, concentration methods

UNIT-II

Protozoan parasites-I: Morphology, life cycle, pathogenesis and lab diagnosis of *Entamoeba histolytica*, *Giardia lamblia*, *Trichomonas vaginalis*, *Trypanosoma brucei gambiense*, *Leishmania donovani*

Protozoan parasites-II: Morphology, life cycle, pathogenesis and lab diagnosis of *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, *Toxoplasma gondii*, *Cryptosporidium parvum*

UNIT-III

Cestodes: Morphology, life cycle, pathogenesis and laboratory diagnosis of *Taenia solium*, *Taenia saginata*, *Echinococcus granulosus*, *Hymenolepis nana*

Trematodes: Morphology, life cycle, pathogenesis and laboratory diagnosis of *Schistosoma mansoni*, *Schistosoma haematobium*, *Paragonimus westermanni*, *Fasciola hepatica*

UNIT-IV

Nematode-I: Morphology, life cycle, pathogenesis and lab diagnosis of *Ascaris lumbricoides*, *Ancylostoma duodenale*, *Trichinella spiralis*

Nematode-II: Morphology, life cycle, pathogenesis and lab diagnosis of *Enterobius vermicularis*, *Wuchereria bancrofti*, *Brugia malayi*, *Strongyloides stercoralis*

Text and Reference Books:

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	Essentials Of Medical Parasitology	Apurba Sankar Sastry And Sandhya Bhat	Jaypee Brothers Medical Publishers Pvt. Ltd.

Clinical Parasitology (Practical)

Course Code	CMB 512
Course Title	Clinical Parasitology (Practical)
Type of course	Practical
L T P	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	To aware the students about Understand the general characteristics and the disease caused by various protozoans and helminths.
Course Outcomes	The students will able to: 1. Know the role of vector in spreading the parasitic diseases 2. Learn the examination of stool and blood samples for diagnosis of disease. 3. Comprehend the techniques for diagnosis of parasites.

LIST OF PRACTICALS

1. Stool and sputum examination

- a) Routine examination of stool and sputum for parasitic infections by physical and chemical method
- b) Routine examination of stool and sputum for parasitic infections by microscopic examination
- c) Preparation of permanently stained smear of the stool sample

2. Giemsa stain

- a) To prepare and perform the Giemsa stain for the identification of malarial parasite from blood sample

3. Stool concentration methods

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

4. Leishman stain

- a) To prepare and perform the Leishman stain for the identification of malarial parasite from blood sample

5. Field stain

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

6. Jaswant Singh Bhattacharjee stain

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

Text & Reference Books:

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

Clinical Biochemistry

Course Code	CMB 514
Course Title	Clinical Biochemistry
Type of course	Theory
L T P	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 students will have knowledge regarding the analysis of biological fluids for its chemical constituents & correlating the same in health & disease.
Course Outcomes	The students will able to: <ol style="list-style-type: none"> 1. Know the role of electrolytes and their distribution. 2. Understand the role of biomolecules and its functions 3. Understand the mechanisms of disorders of metabolism

UNIT- I

Electrolytes and Acid-Base Balance: Assessing fluid and electrolyte status, Disturbances of sodium, Disturbances of potassium, Plasma and urine osmolality.

Acid Base Balance: Acid, bases and buffers, Classification of acid-base disorders.

UNIT- II

Liver function tests: Introduction and functions of liver, metabolic and excretory functions, protection and detoxification, liver profile test: serum bilirubin and VD Bergh reaction, serum transaminases, alkaline phosphatase, gamma-glutamyl transferase, principle and clinical importance of liver markers.

UNIT- III

Kidney Function Tests: Introduction and functions of kidneys, Formation of urine, Hormonal regulation of kidneys, Kidney function tests, Diseases of Kidneys.

UNIT- IV

Disorders of Metabolism: Diabetes mellitus, galactosemia, lactose intolerance.

Inborn diseases of metabolism: phenylketouria, albinism, gout, hyperglycemia, phenylalaninemia, homocystineuria, tyrosinemia.

Cancer Biochemistry: Causes and Types of Cancer, Treatment and markers.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Text book of Medical Laboratory Technology	Paraful B. Godkar, Darshan P. Godkar	Bhalani Publisher
2	Medical laboratory Technology Volume-III (2 nd Ed.)	KL Mukherjee	Tata McGraw Hill
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.
5.	Medical Laboratory Sciences, Theory & Practical	Arundhati Kolhatkar & J. ochei	McGraw Hill

Clinical Biochemistry Lab

Course Code	CMB 516
Course Title	Clinical Biochemistry (Practical)
Type of course	Practical
L T P	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	To provide students' knowledge Identify biochemical tests useful in diagnosis and monitoring response to therapy.

LIST OF PRACTICALS

1. Quantitative analysis of blood parameters
2. Quantitative estimation of blood cholesterol
3. Quantitative estimation of blood glucose
4. Quantitative estimation of blood urea.
5. Quantitative analysis of blood parameters
6. Quantitative estimation of creatinine
7. Quantitative estimation of protein & albumin
8. Quantitative estimation of uric acid.
9. Quantitative analysis of liver enzymatic markers
10. Quantitative estimation of SGPT
11. Quantitative estimation of ALP.
12. Quantitative analysis of heart enzymatic marker
13. Quantitative estimation of SGOT a cardiac marker.
14. Quantitative analysis of prostate gland enzymatic marker
15. Quantitative estimation of ACP.

Text & Reference Books:

S.No.	Name/Title	Author	Publisher
1	Biochemistry	Voet, D. and J.G. Voet	Freeman & Co
2	Biochemistry	Lehniger	
3	Essentials of Molecular Biology	Freifelder, D	Freeman & Co
4	Biochemical Calculations	Segal, I.H	J. Wiley and Sons

Introductory Concepts of Computer Technology

Course Code	CSE554
Course Title	Introductory Concepts of Computer Technology
Type of course	Theory
L T P	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	To aware students about the basic fundamentals of computer and its use in day today life.
Course Outcomes	The students will able to: <ul style="list-style-type: none"> • Understand Basics of computer and its operating system • Distinguish the types of Software • 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);

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.

Text and Reference Books:

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

Introductory Concepts of Computer Technology Practical

Course Code	CSE556
Course Title	Introductory Concepts of Computer Technology Practical
Type of course	Practical
L T P	0 0 2
Credits	1
Course prerequisite	B.Sc. Non Medical or B. Sc. Medical with Zoology as main subject
Course Objective	To aware students about the basic fundamentals of computer and its use in day today life.
Course Outcomes	The students will able to: I. Learn the basics of computer and its operating system II. Understand the working of different softwares III. 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.

Text and Reference Books:

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

Natural Hazards and Disaster Management

Course Code	EVS003
Course Title	Natural Hazards and Disaster Management
Type of course	Theory Course
L T P	3 0 0
Credits	3
Course prerequisite	Graduation
Course Objective	To learn about natural hazards, risk assessment and disaster management
Course Outcomes	The students will able to: 1. 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.

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 organisation: Key operational issues, utilisation 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.

Text and Reference books:

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

Third Semester

Medical Mycology

Course Code	CMB601
Course Title	Medical Mycology
Type of course	Theory
L T P	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	To give practical demonstration to the students to develop insight into pathogenicity, diagnosis and prophylaxis of fungal infections.
Course Outcomes	Students will be able to: <ol style="list-style-type: none"> 1. Identify clinically important fungi. 2. Describe general characteristics and classes of fungi. 3. Differentiate between superficial, subcutaneous, systemic and opportunistic 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*, *coccidioidomycosis*, *histoplasmosis*, *blastomycosis*.

Opportunistic mycoses- Pathogenicity, clinical features and laboratory diagnosis of *cryptococcosis*, *candidiasis*, *aspergillosis*, *penicillois*, *zygomycosis*.

Text & Reference Books:

S.No.	Name/Title	Author	Publisher
1	A guide to study of basic medical mycology	Kee Peng Ng et al.	Kindle Edition
2	Medical Mycology: A self instructional text	Kathleen S. Blevins	
3	Fundamental Medical Mycology	Errol Reiss et al.	Wiley-Blackwell

Medical Mycology (Practical)

Course Code	CMB603
Course Title	Medical Mycology (Practical)
Type of course	Practical
L T P	0 0 3
Credits	1.5
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	To give practical demonstration to the students to develop insight into pathogenicity, diagnosis and prophylaxis of fungal infections.
Course Outcomes	Students will be able to: 1. Identify clinically important fungi. 2. Describe general characteristics and classes of fungi. 3. 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.

Text and Reference Books:

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

Medical Virology

Course Code	CMB605
Course Title	Medical Virology
Type of course	Theory
L T P	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	Develop insight into pathogenicity, diagnosis and prophylaxis of viral infections
Course Outcomes	Students will be able to: 1. Identify clinically important viruses 2. Describe general characteristics and classes of viruses

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

Text & Reference Books:

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.	
3	Medical Virology: A practical Approach	U. Desselberger	Oxford University Press

Medical Virology (Practical)

Course Code	CMB607
Course Title	Medical Virology (Practical)
Type of course	Practical
L T P	0 0 3
Credits	1.5
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	Develop insight into pathogenicity, diagnosis and prophylaxis of viral infections.
Course Outcomes	Students will be able to: 1. Identify clinically important viruses. 2. Study of procedure used in performing various lab 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 counter immune electrophoresis for detection of viral antigens or antiviral antibodies.
5. Handling of mice, rats, guinea pigs, rabbits for collection of blood, pathogenicity test etc.

Text and Reference Books:

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

Recombinant DNA Technology (RDT)

Course Code	CMB609
Course Title	Recombinant DNA Technology (RDT)
Type of course	Theory
L T P	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	To sentient students about the different new techniques and terminology related to molecular biology and recombinant DNA technology .
Course Outcomes	The students will able to: <ol style="list-style-type: none"> 1. Understand the properties, structure and function of genes in living organism at the molecular level, working of enzymes used in RDT 2. Knowledge of different cloning vectors and cloning techniques including- isolation, transformation and transfection methods

UNIT-I

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

UNIT -II

Gene cloning vectors: Plasmids, Cosmids, Bacteriophage; Phagemids, BAC, YAC; Shuttle vector.

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

UNIT-III

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

UNIT -IV

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

Text and Reference Books:

S.No.	Name/Title	Author	Publisher
1	Gene Cloning and DNA Analysis	T A Brown	Blackwell
2	From Genes to Genomes: Concepts and Applications of DNA Technology, 3rd Edition	Jeremy W. Dale, Malcolm von Schantz, Nicholas Plant	Wiley
3	From genes to clones introduction to gene technology	by Ernst L. Winnacker	John Wiley

Molecular Biology and Bioinformatics

Course Code	CMB611
Course Title	Molecular Biology and Bioinformatics
Type of course	Theory
L T P	3 1 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	To aware the students about biological activity between biomolecules in the various systems of a cell, including the interactions between DNA, RNA and proteins and their biosynthesis, as well as the regulation of these interactions.
Course Outcomes	The students will able to: <ol style="list-style-type: none"> 1. Understand the basic of molecular biology and its techniques like PCR, RTPCR etc. 2. Also be rendered to sensitize students to take up future molecular biology challenges.

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).

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

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

Chemical composition of DNA, DNA replication, DNA damage and repair, PCR: Principle, Procedure, Types And Applications

UNIT-IV

Transcription and Translation: Mechanism of Transcription in prokaryotes & Eukaryotes; Processing of RNA:- m-RNA processing, 5' capping, 3' polyadenylation, Mechanism, of translation; Post translational modification of proteins.

Text and Reference Books:

S.No.	Name/Title	Author	Publisher
1	Bioinformatics: Principles and Applications	Zhumur Ghosh , Bibekanand Mallick	oxford
2.	Molecular Biology	Dr. P.S. Verma, Dr. V.K. Agarwal	S.Chand Publications

Medical Laboratory Management

Course Code	CMB613
Course Title	Medical Laboratory Management
Type of course	Theory
L T P	3 1 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 students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab. In addition they will understand sample accountability, quality management system, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS) Chromatography and automation in Clinical Biochemistry etc.
Course Outcomes	The students will able to: <ol style="list-style-type: none"> 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

UNIT IV**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 V**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

Text and Reference Books:

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

Seminar

Course Code	CMB615
Course Title	Seminar
Type of course	Practical
L T P	0 0 2
Credits	1
Course prerequisite	M.Sc Clinical Microbiology as Skill Enhancement Course
Course Objective (CO)	The students will prepared presentation to impart skills or knowledge
Course Outcome	It provide an opportunity to students to develop skills in presentation and discussion of research topics.

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 The average marking will be taken into consideration.

Fourth Semester

Dissertation/Project

Course Code	CMB602
Course Title	Dissertation/Project
Type of course	Practical
L T P	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 students will undergo 5 months training to learn about latest techniques used in research

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 powerpoint 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.