GURU KASHI UNIVERSITY

Master of Science in Medical Laboratory Technology

Session: 2022-23

Department of Paramedical Sciences

Programme Learning outcomes

- Research Proficiency: Graduates should demonstrate advanced skills in conducting research related to medical laboratory technology. This includes the ability to design experiments, collect and analyse data, and draw meaningful conclusions.
- Critical Thinking: Graduates should possess strong critical thinking skills to evaluate complex laboratory findings, interpret results, and make informed decisions. They should be able to analyse information critically, identify problems, and propose appropriate solutions.
- Leadership and Collaboration: Graduates should be capable of assuming leadership roles within a laboratory setting. They should have the ability to effectively communicate and collaborate with interdisciplinary teams, including physicians, technologists, and other healthcare professionals.
- Continuous Learning: Graduates should display a commitment to lifelong learning and professional development. They should actively seek opportunities to update their knowledge and skills in response to advancements in medical laboratory technology.
- Technological Proficiency: Graduates should be proficient in utilizing advanced laboratory equipment, computer systems, and software applications relevant to their field.
- Quality Assurance and Compliance: Graduates should understand the importance of quality assurance in laboratory testing and be able to implement and monitor quality control measures. They should also have knowledge of regulatory compliance standards and ensure adherence to relevant guidelines and protocols.

Programme structure

Semester -I							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	MML101	General Microbiology	Core course	4	0	0	4
2	MML102	Immunology	Core course	4	0	0	4
3	MML103	Systemic Bacteriology	Core course	4	0	0	4
Discipline Elective (Any one of the following)							
4	MML104	General Biochemistry	Disciplinary Elective	3	0	0	3
5	MML105	General Hematology					
6	MML106	General Patient Care in Hospital	Ability Enhancement	1	0	0	1
7	MML107	General Microbiology Laboratory	Technical skills	0	0	4	2
8	MML108	Immunology Laboratory	Technical skills	0	0	4	2
9	MML109	Systemic Bacteriology Laboratory	Technical skills	0	0	4	2
Value Added Course For other disciplines also							
10	MML110	Fundamental Concepts in MLT	VAC	2	0	0	2
			TOTAL	**18**	**0**	**12**	**24**

Semester -II							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	MML201	Advanced Techniques in Bacteriology	Core Course	4	0	0	4
2	MML202	Advanced techniques in Microbiology	Core Course	4	0	0	4
Disciplinary Elective (Any one of the following)							
3	MML205	Clinical Biochemistry	Disciplinary Elective	3	0	0	3
4	MML206	Clinical Hematology					
5	MML207	Research Proposal	Research based skills	4	0	0	4
6	MML208	Advanced Techniques in Bacteriology Laboratory	Technical skills	0	0	4	2
7	MML209	Advanced techniques in Microbiology Laboratory	Technical skills	0	0	4	2
Open Elective (For other departments only)							
8	Open Elective			2	0	0	2
			TOTAL	**17**	**0**	**8**	**21**
Open Elective (For other departments only)							
9	MML203	First Aid	Open Elective	2	0	0	2
10	MML204	Fitness and Health Management					

Semester -III							
S. No	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	MML301	Virology and Mycology	Core course	4	0	0	4
2	MML302	Parasitology & Mycology	Core course	4	0	0	4
Disciplinary Elective (Any one of the following)							
3	MML303	General Pathology and Terminology	Disciplinary Elective	3	0	0	3
4	MML304	Histopathology and Cytology					
Disciplinary Elective (Any one of the following)							
5	MML305	Biomedical Waste Management	Disciplinary Elective	3	0	0	3
6	MML306	Medical Laboratory Management and Medical Ethics					
	Value Added Course						
7	MML307	Innovation and Entrepreneurship	VAC	2	0	0	2
8	MML308	Virology and Mycology Laboratory	Technical skills	0	0	4	2
9	MML309	Parasitology & Mycology Laboratory	Technical skills	0	0	4	2
10	MML310	Clinical Visit	Technical skills	0	0	4	2
11	MML311	Skill and Personality Development	Ability Enhancement	2	0	0	2
			TOTAL	**18**	**0**	**12**	**24**

Semester-IV						
S. No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	MML401	Dissertation	0	0	0	20
		Total	**0**	**0**	**0**	**20**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]
   i. Surprise Test (Two best out of three) - (10 Marks)
   ii. Term paper (10 Marks)
   iii. Assignment(s) (10 Marks)
   iv. Attendance (5 marks)
B. Mid Semester Test-1: [30 Marks]
C. MST-2: [20Marks]
D. End-Term Exam: [20 Marks]

Evaluation Criteria for other courses has been given separately with the Respective courses

Semester: 1st

Course Title: General Microbiology

Course Code: MML101

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes:

On completion of this course, the successful students will be able to:

- Know the bacterial, fungal, and parasitic species by microscopic examination.
- Acquire the basic knowledge of lab. Diagnosis of pathogenic microorganisms that helps in treatment of diseases.
- Learn the ideas about the introduction of infection and its types, pathogenicity and laboratory diagnosis of nosocomial infection.
- Analyze the rule of microbial growth identification and laboratory diagnosis of bacterial infection, prevention and control of infections.

Course Contents

UNIT- I **14 Hours**

Introduction, history & scope of Microbiology: Introduction and historical developments of microbiology, scope of microbiology, general characteristics of prokaryotes and eukaryotes, classification of prokaryotes, introduction to mycology, virology and parasitology

UNIT-II **16 Hours**

Microscopy: Importance of microscopy, principle, operation and applications of light microscope, phase contrast microscopy, fluorescence microscopy, electron microscopy

Structure of Bacterial cell :General structure and functions of gram positive and gram negative bacteria, cell wall, cell membrane, cytoplasmic inclusions and mesosomes, flagella, capsule, ribosome, chromosome, plasmid and endospore, morphological classification of bacteria

UNIT-III **16 Hours**

Sterilization & disinfection: Introduction and its types, principle, procedure and its application, quality control for sterilization and disinfectant techniques, biosafety in microbiology lab.

Nutrition & growth: kinetics of growth, continuous culture and synchronous growth cultures, aerobic & anaerobic cultures, Introduction and its types, various factors affects on microbial growth.

Chemotherapeutic agents: Introduction, types, mode of action and its clinical importance of antibiotic sensitivity tests, Introduction, types, mode of action and importance of multiple drugs resistance, mechanism of drug resistance.

UNIT-IV **14 Hours**

Lab diagnosis of pathogenic microorganisms: Normal microbial flora of the human body, collection and transport of specimens, processing of clinical specimens for microbiological examination

Environmental and applied microbiology: Bacteriology of air, water, food, milk

Nosocomial infections: Introduction and its types, pathogenicity and laboratory diagnosis of nosocomial infection, prevention and control of nosocomial infections

Transaction Modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Brown, A., & Smith, H. (2014). Benson’s Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
2. Brown, A., & Smith, H. (2014). Benson’s Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
3. E Brown, A. (2001). Benson's Microbiological Applications Laboratory Manual in General Microbiology-Alfred E Brown.

4. Tortora, G. J., Funke, B. R., Case, C. L., Weber, D., & Bair, W. (2004). Microbiology: an introduction (Vol. 9). San Francisco, CA: Benjamin Cummings.
5. Parija, S. C. (2013). Textbook of Microbiology & Immunology-E-book. Elsevier Health Sciences.
6. Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2020). Medical microbiology E-book. Elsevier Health Sciences.

Semester: 1st

Course Title: Immunology

Course Code: MML102

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Learn about immune system, antigens, antibodies, immunoglobulin, monoclonal antibodies, and immunoglobulin and their structure and function.

2 Have Knowledge about the antigen - antibody binding, precipitation and agglutination reaction, immuno-electrophoresis and immunofluorescence, ELISA and Western blotting, their use in diagnosis.

3 Understand the action of vaccine against AIDS, immune system, cancer and other immune deficiencies diseases.

4 Analyze immuno-electrophoresis and immune fluorescence, ELISA and Western blotting, their use in diagnosis.

5 Understand the factors responsible for Antigen-antibody reactions and their significance in diagnosis tools.

Course Contents

UNIT-I **14 Hours**

Immune System: Introduction and overview on innate and adaptive immunity, primary and secondary lymphoid tissues and organs, cells of immune system

Antigens: Factors responsible for immunogenicity, immunogen, hapten and adjuvant, epitopes, heterophile antigen, super antigen

Antibodies: Structure and function of immunoglobulin, monoclonal antibodies, immunoglobulin genes, generation of antibody diversity, immunoglobulin super family

UNIT-II **16 Hours**

Antigen-antibody reactions: Molecular mechanism of antigen - antibody binding, precipitation and agglutination reaction, immuno-electrophoresis and immune fluorescence, ELISA and Western blotting

MHC: Structure of MHC molecules, MHC and peptide interaction, antigen processing and presentation, transplantation rejection, HLA complex in human

UNIT-III **16 Hours**

Cytokines and Regulation: Common properties of cytokines and cytokine types, biological activities of cytokines, pro-inflammatory cytokines, cytokine diseases and therapies

B-cell and T-cell Activation :BCR and TCR, cell interactions in antibody response, B cell activation, synthesis and secretion of immunoglobulin's, T cell maturation, activation and differentiation

Humoral and cell-mediated effectors responses: Immune responses to infection, leukocyte recirculation and inflammation, neutralization, opsonisation and ADCC, vaccines

UNIT-IV **14 Hours**

Tolerance and Autoimmunity: Mechanism of self tolerance, hypersensitivity reactions, AIDS and other immune deficiencies, cancer and the immune system

Complement System: Introduction to complement system, classical, alternative and lectin complement pathway, biological effect of complement system, regulation of complement system

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Brown, A., & Smith, H. (2014). Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
2. Brown, A., & Smith, H. (2014). Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
3. E Brown, A. (2001). Benson's Microbiological Applications Laboratory Manual in General Microbiology-Alfred E Brown.
4. Tortora, G. J., Funke, B. R., Case, C. L., Weber, D., & Bair, W. (2004). Microbiology: an introduction (Vol. 9). San Francisco, CA: Benjamin Cummings.
5. Parija, S. C. (2013). Textbook of Microbiology & Immunology-E-book. Elsevier Health Sciences.
6. Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2020). Medical microbiology E-book. Elsevier Health Sciences.

Semester: 1st

Course Title: Systemic Bacteriology

Course Code: MML103

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to:

1 Identify various bacterial contaminants present in sample.

2 Illustrate morphology, biochemical reactions, to differentiate bacteria and their related diseases.

3 Differentiate between gram positive and gram negative bacteria by using staining.

4 Perform antibiotic susceptibility testing for recommendation of antibiotic for treatment.

5 Learn structural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Corynebacterium, Bacillus and Clostridium

Course Contents

UNIT-1 **16 Hours**

Epidemiology and control of community infections: Study of normal flora of human body, control and prevention of community, epidemiological markers, different carries and sources of infection

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

Gram positive bacilli: A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Corynebacterium, Bacillus and Clostridium

UNIT-II **14 Hours**

Acid fast bacteria and Gram negative cocci: A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Mycobacterium tuberculosis and Mycobacterium leprae, Neisseria

Enterobacteriaceae-I: A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Enterobacterifamilies like E.coli and Klebsiella, Shigella and Salmonella

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

UNIT-III **18 Hours**

Gram negative bacilli-I: A detailed account of cultural and morphologicalcharacteristics, pathogenicity, clinical manifestations and laboratory

diagnosis of Pseudomonas aeruginosa and Vibrio, Haemophilusinfluenzae and Campylobactorjejuni

Gram negative bacilli-II: A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Bordetella pertussis and Yersinia pestis, Bacteroides and Helicobacter pylori

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

UNIT-IV **12 Hours**

Miscellaneous bacteria-II: A detailed account of cultural and morphological characteristics, pathogenicity, clinical manifestations and laboratory diagnosis of Actinomycetes (Actinomyces and Nocardia) and Spirochaetes (Treponema, Borrelia, Leptospira), Brucellae and Listeria monocytogenes

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's textbook of microbiology*. Orient Blackswan
2. Panjarathinam, R. (2007). *Medical microbiology*. New Age International.
3. Kumar, S. (2012). *Textbook of microbiology*. JP Medical Ltd.
4. Willey, J. M., Sherwood, L., & Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.
5. Tortora, G. J., Funke, B. R., & Case, C. L. (2007). *Microbiology: an introduction* (p. 912). San Francisco, CA: Pearson Benjamin Cummings.
6. Lederberg, J. (2000). *Encyclopedia of microbiology, four-volume set*. Academic Press.
7. Mahon, C. R., Lehman, D. C., & Manuselis, G. (2018). *Textbook of diagnostic microbiology-e-book*. Elsevier Health Sciences.

8. Procop, G. W., Church, D. L., Hall, G. S., & Janda, W. M. (2020). *Koneman's color atlas and textbook of diagnostic microbiology*. Jones & Bartlett Publishers.

Semester: 1st

Course Title: General Biochemistry

Course Code: MML104

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Understand biomolecules, metabolism and inborn errors of metabolism.
2. Recall various organ function tests and their significance in result interpretation.
3. Correlate the knowledge of patho-physiology of organ system and hormonal imbalance.
4. Apply biochemical changes involved in various clinical conditions associated with glands and organs of human body.
5. Identify deficiency diseases and their correlate conditions including interpretations.

Course Contents

UNIT-I **12 Hours**

Chemistry and metabolism of Carbohydrates- Definition, classification, important function, properties, digestion and absorption and metabolic fates

UNIT-II **11 Hours**

Chemistry and metabolism of lipids- -Definition, classification, importance, properties, digestion and absorption general metabolism, cholesterol, lipoproteins

UNIT-III **10 Hours**

Chemistry and metabolism of proteins- -Definition -Important properties of proteins and amino acids -general metabolism of different amino acids

UNIT-IV **12 Hours**

Chemistry and metabolism of nucleic acids- -Definition -Importance - properties of nucleic acids**,** purine and pyridine metabolism.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested readings

1. Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). Biochemistry. Lippincott Williams & Wilkins.
2. Ferrier, D. R. (2014). Biochemistry. Lippincott Williams & Wilkins.
3. Varley, H. (1954). Practical clinical biochemistry. Practical clinical biochemistry.
4. Lucock, M. (2000). Folic acid: nutritional biochemistry, molecular biology, and role in disease processes. Molecular genetics and metabolism, 71(1-2), 121-138.
5. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.
6. Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K. (2013). Textbook of biochemistry for medical students. JP Medical Ltd.

Semester: 1st

Course Title: General Haematology

Course Code: MML104

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Perform routine hematological tests and collection of specimens, reception and labeling and recording of laboratory investigations.
2. Learn about the blood cell formation and its composition, factor affecting production of blood cells, Preparation of smears and staining for diagnostic purposes.
3. Understand working, maintenance and calibration of cell counters.
4. Perform hematological testing for diagnosis, internal quality control, external quality control, standardization of instruments.
5. Prepare anticoagulants and their uses in various investigations.

Course Contents

UNIT-I **11 Hours**

Introduction to hematology: Definition, importance, important equipment and chemicals, various tests performed, laboratory organization and safety measures in hematology laboratory. Composition and function of blood: Definition of blood, composition of blood (cells, plasma /serum) Formation of blood: Erythropoiesis, Leucopoiesis, Thrombopoiesis.

UNIT-II **12 Hours**

Anticoagulants: Definition , uses, different types , mode of action, their merits and demerits Collection And Preservation of blood Sample for various hematological investigation, Definition, Principle &Procedure, Normal values, Clinical significance, Errors involved, Mean to minimize errors for the following.

UNIT-III **10 Hours**

Haemoglobinometery: Haemoglobinometery defination, Total Leucocyte count (TLC), Differentiate leucocyte count (DLC), Erythrocyte Sedimentation Rate (ESR), Packed cell volume/ Hematocrit value, Red cell indices (RCL), Absolute Eosinophil count (ESR), Reticulocyte count, Platelet count, Preparation of blood films.

UNIT-IV **12 Hours**

Types methods of preparation (Thick and thin smear/film) staining technique in Hematology (Romansky stains): Principle, composition, preparation staini8ng reagents and procedure for the Giemsa and Leishman stain.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Wintrobe, M. M. (1962). Clinical hematology. *Academic Medicine*, *37*(1), 78.
2. Bain, B. J., Bates, I., & Laffan, M. A. (2016). *Dacie and lewis practical haematology e-book*. Elsevier Health Sciences.
3. Robbins, S. L. (2002). *Pocket companion to Robbins pathologic basis of disease*. Elsevier Health Sciences TW.
4. Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
5. Godkar, P. B., & Godkar, D. P. (2003). *Textbook of medical laboratory technology*. Bhalani.
6. Sood, R. (2009). *Concise Book of Medical Laboratory Technology: Methods and Interpretations*. Jaypee Brothers Medical Publishers (P) Limited.
7. Mukherjee, K. L. (2010). *Med Lab Tech Vol 1, 2/e*. Tata McGraw-Hill Education.
8. Kolhatkar, A., Ochei, J., & McGraw, T. (2008). Medical Laboratory Science: Theory and Practice.
9. Kawthalkar, S. M. (2012). *Essentials of haematology*. JP Medical Ltd.

Semester: 1st

Course Title: General Patient Care in Hospital

Course Code: MML105

L	T	P	Cr.
1	0	0	1

Total Hours 15

Course Learning Outcomes: On completion of this course, the successful students will be able to

1	Gain knowledge regarding maintenance of medical record and documents in radiology department
2	Understand transferring the patients without causing any hurdle and restrain the un co-operative patients throughout radiological examinations.
3	Categorize the moral, clinical and ethical liability of radiographer.
4	Analyze sterilized techniques to reduce the chance of infection in work practices.
5	Evaluate the vital signs, handle equipments used for diverse procedures.

Course Contents

UNIT-I **12 Hours**

Hospital Staffing and Administration, records, professional, ethics, cooperation with other staff and departments, Departmental organizations. Handling of the patients, seriously ill and traumatized patients, visually impaired, speech and hearing impaired, mentally impaired, drug addicts and non-English speaking patients. Understanding patient needs - patient dignity of inpatient and out patients. Interaction with the patient's relatives and visitors.

UNIT-II **10 Hours**

Methods of Effective Communication - Verbal skills, body language, professional appearance, visual contact etc. Elementary personal and departmental hygiene, dealing with receptacles, bedpans and urinals etc. General preliminaries to the exam.

UNIT-III **11 Hours**

Patient. **Care** - Unconscious patient shifting on moving chair and stretcher, general comfort and reassurance for the patient. Vital signs and oxygen - patient's Homeostasis status. Body temp, respiratory rate, pulse, blood pressure, oxygen therapy, oxygen devices, Chest tubes and lines.

UNIT-IV **12 Hours**

First Aid - Shock, electrical shock, hemorrhage, burns, Asphyxia, fractures, loss of consciousness. Emergency treatment to the collapsed patient. Artificial respiration and resuscitation. Preparation of patients for general and special radiological examinations. Supervision of patients undergoing special examination. Administration of drugs and contrast media. Aseptic and Sterile procedures. Handling of infections patients in the department or in the ward. Regulation of dangerous drugs. Trolley set up for special x-ray examinations, Radiation hazardous

and protective measures.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ashalatha, P. R., &Deepa, G. (2012).*Textbook of Anatomy & Physiology for Nurses*. JP Medical Ltd.
2. Pal, G. K. (2006).*Textbook Of Practical Physiology-2Nd Edn*. Orient Blackswan.
3. Ehrlich, R. A., &Coakes, D. M. (2016).*Patient care in radiography-ebook: with an introduction to medical imaging*. Elsevier Health Sciences.
4. Adler, A. M., & Carlton, R. R. (2015).*Introduction to Radiologic and Imaging Sciences and Patient Care-EBook*.Elsevier Health Sciences.

Semester: 1st

Course Title: General Microbiology Laboratory

Course Code: MML106

L	T	P	Cr.
0	0	2	1

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Prepare bacterial smear from different bacterial cultures to identify bacterial strain.

2 Know the effect of different carbon nitrogen sources on the growth of microorganisms, effect of environmental factors on growth.

3 Observe the effect of pH on the growth of microorganisms.

4 Perform the bacteriological examination of water and milk.

5 Analyze gram negative and special stains for bacterial identification.

Course Contents

List of Practical's / Experiments:

Simple staining of bacteria

To prepare bacterial smear and perform simple staining using methylene blue

Gram staining

To perform Gram staining of different bacterial cultures

Special stain

To perform endospore staining and Albert's staining of bacterial cultures

Counting of bacteria

To perform viable count of bacteria using pour plating technique

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

Bacteriological examination of water & milk

To perform the bacteriological examination of water and milk

To perform the bacteriological examination of milk by methylene reductase test

Microbes in hospital environment

To isolate and identify the bacteria and fungi from hospital environment

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings-

1. Brown, A., & Smith, H. (2014). Benson’s Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
2. Brown, A., & Smith, H. (2014). Benson’s Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
3. E Brown, A. (2001). Benson's Microbiological Applications Laboratory Manual in General Microbiology-Alfred E Brown.
4. Tortora, G. J., Funke, B. R., Case, C. L., Weber, D., & Bair, W. (2004). Microbiology: an introduction (Vol. 9). San Francisco, CA: Benjamin Cummings.

5. Parija, S. C. (2013). Textbook of Microbiology & Immunology-E-book. Elsevier Health Sciences.
6. Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2020). Medical microbiology E-book. Elsevier Health Sciences.

Semester: 1st

Course Title: Immunology Laboratory

Course Code: MML107

L	T	P	Cr.
0	0	4	2

Course Learning Outcomes: On completion of this course, the successful students will be able to:

1 Acknowledge immune system, antigens, antibodies, immunoglobulin, monoclonal antibodies, and immunoglobulin and their structure and function.

2 Recall antigen - antibody binding, precipitation and agglutination reaction.

3 Assess vaccine against AIDS, immune system, cancer and other immune deficiency diseases.

4 Demonstrate factors responsible for Antigen-antibody reactions and their significance in diagnosis tools

5 Analyze immuno-electrophoresis and immune fluorescence, ELISA and Western blotting, their use in diagnosis.

Course Contents

List of Practical's / Experiments:

To perform VDRL Tests.

To perform Brucella Agglutination test.

To perform Weil Felix test (Demonstration only).

To perform Paul Bunnel test (Demonstration only).

To perform RA test.

To perform CRP test.

To perform TPHA test.

To perform ELISA test.

To perform ASLO test.

To perform Widal test.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Semester: 1st

Course Title: Systemic Bacteriology Laboratory

Course Code: MML108

L	T	P	Cr.
0	0	4	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Understand and identify microbes from skin/pus samples.

2 Isolate microorganism and perform identification of various bacterial strains from different samples.

3 Prepare specific media used for culture, identification and differentiation process of microorganism.

4 Collect samples from various sites of body for diagnose and culture of microorganism.

5 Analyze Bacteriological examination of pathogens present in air.

Course Contents

List of Practical's / Experiments:

To isolate and identify the pathogenic microorganisms from skin/pus.

To isolate and identify the pathogenic microorganisms from blood sample.

To isolate and identify the pathogenic microorganisms from Urine sample.

To isolate and identify the pathogenic microorganisms from throat.

To isolate and identify the pathogenic microorganisms from sputum sample.

To isolate and identify the pathogens present in air.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's textbook of microbiology*. Orient Blackswan
2. Panjarathinam, R. (2007). *Medical microbiology*. New Age International.
3. Kumar, S. (2012). *Textbook of microbiology*. JP Medical Ltd.
4. Willey, J. M., Sherwood, L., & Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.
5. Tortora, G. J., Funke, B. R., & Case, C. L. (2007). *Microbiology: an introduction* (p. 912). San Francisco, CA: Pearson Benjamin Cummings.
6. Lederberg, J. (2000). *Encyclopedia of microbiology, four-volume set*. Academic Press.
7. Mahon, C. R., Lehman, D. C., & Manuselis, G. (2018). *Textbook of diagnostic microbiology-e-book*. Elsevier Health Sciences.
8. Procop, G. W., Church, D. L., Hall, G. S., & Janda, W. M. (2020). *Koneman's color atlas and textbook of diagnostic microbiology*. Jones & Bartlett Publishers.

Semester: 1st

Course Title: Fundamental Concepts in M.L.T.

Course Code: MML109

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Understand biomolecules, metabolism and inborn errors of metabolism.

2 Recall various organ function tests and their significance in result interpretation.

3 Correlate the knowledge of patho-physiology of organ system and hormonal imbalance.

4 Apply biochemical changes involved in various clinical conditions associated with glands and organs of human body.

5 Identify deficiency disease and their correlate conditions including interpretations.

Course Contents

UNIT-I **16 Hours**

Basic principles and procedures of Laboratory: to develop understanding of the concept of healthy living, laboratory hazards, measuring and dispensing liquid, safety precautions with glass and plastic containers, choose glass or plastic container, clean glass and plastic, pH and buffer solution, procedure of hand hygiene, to be equipped with techniques of use of PPE.

UNIT-II **14 Hours**

Care and maintenance of glassware: for example beaker, jars, flasks, test-tubes, Petri dishes, microscope slides, graduated cylinders, graduated pipette, stirring rods etc. cleaning methods, storage of glassware and glass apparatus, types of different laboratory equipments and instrument examples are balance, Bunsen burner, funnel, pipette bulb, autoclave, centrifuge, laminar air flow, hot air oven, incubator, water bath, cell counter, microscope etc.

UNIT-III **17 Hours**

Introduction to different laboratory reagents , solutions and stains : for example carbol fuchsin, gram's iodine, giemsa, crystal violet, Leishman, safranin, preparation of reagents for example hypochlorite, ethanol, formaldehyde etc. preparation of different types of media and agar.

UNIT-IV **13 Hours**

Infection control and prevention: Understand practices to curb infection, hospital borne infection, prevention and treatment of needle stick injury, understand the management of blood and body substance spillage in the health care setting.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Wintrobe, M. M. (1962). Clinical hematology. *Academic Medicine*, *37*(1), 78.

2. Bain, B. J., Bates, I., & Laffan, M. A. (2016). *Dacie and lewis practical haematology e-book*. Elsevier Health Sciences.
3. Robbins, S. L. (2002). *Pocket companion to Robbins pathologic basis of disease*. Elsevier Health Sciences TW.
4. Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
5. Godkar, P. B., & Godkar, D. P. (2003). *Textbook of medical laboratory technology*. Bhalani.
6. Sood, R. (2009). *Concise Book of Medical Laboratory Technology: Methods and Interpretations*. Jaypee Brothers Medical Publishers (P) Limited.
7. Mukherjee, K. L. (2010). *Med Lab Tech Vol 1, 2/e*. Tata McGraw-Hill Education.
8. Kolhatkar, A., Ochei, J., & McGraw, T. (2008). Medical Laboratory Science: Theory and Practice.
9. Kawthalkar, S. M. (2012). *Essentials of haematology*. JP Medical Ltd.

Semester: 2nd

Course Title: Advanced Techniques in Bacteriology

Course Code: MML201

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Characterize and Identify bacterial pathogen present in samples.
2 Illustrate morphology, biochemical reactions, to differentiate bacterial biomarkers.
3 Differentiate bacterial pathogen screening by using screening tool.
4 Perform deferent -2 screening test of diagnosis.
5 Learn about additional screening tools of laboratory diagnosis cancer.

Course Contents

UNIT-I **14 Hours**

Characterization of bacterial pathogen directly in clinical specimens: Nucleic acid Amplification test, Advancement in PCR Technology e.g. Qualitative Real Time

PCR, Next Generation Sequencing (NGS), Multiplex PCR, Nested PCR, Real Time PCR, MALDI-MS

UNIT-II **16 Hours**

Biomarkers and Algorithms for diagnosis of Ovarian Cancer: Human Epididymis Protein 4 (HE-4), Diadnosis of HE 4 in Ovarian Cancer,CA 125 marker of Ovarian Cancer,serum CA 124 assay for the detection of early stage ovarian cancer, marker of Ovarian Cancer Risk of Malignancy Index (RMI), Risk of Ovarian Malignancy Algorithm (ROMA).

UNIT-III **13 Hours**

Biomarkers in Ovarian Pathology screening to diagnosis: Neoplasm, Ovarian Neoplasm, Ovarian Cancer (OC), High grade Serious Carcinoma (HGSC). Multimodality Screening – Prostate, Lung, Colorectal, Ovarian Cancer (PLCO) screening.

UNIT-IV **17 Hours**

Screening Tools: OVA 1 Test, Additional Biomarkers: Apolipoprotein A1 (Apo A1) Beta 2 microglobulin, transferring, Mass Spectrometry based Proteomics: Ovarian Cancer, Gynecology Oncology, Epithelial Ovarian Cancer – standard and cut-off values of serum ca-125, HE4 and ROMA, Carbohydrate 125.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Magdalena Elwira Zokowska, (2021). “Advanced methods of bacteriological identification in clinical microbiology laboratory” J. Pre Clin Clin Res. 15 (2) 68-72.
2. V. Dochez, H Callion, E. Vaucel, J Dimet, (2019), Biomarkers and algorithms for diagnosis of ovarian cancer: CA125, HE4, RMI and ROMA – A review Journal of Ovarian
3. K. Al Musahi, M Al Kindi, F Al Aisary (2016) “Evaluation of HE4, CA-125, risk of ovarian malignancy algorithm (ROMA) and risk of malignancy index (RMI) in the preoperative assessment of patiens with adnexal

Semester: 2nd

Course Title: Advanced Techniques in Microbiology

Course Code: MML202

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Identify pathogen present in samples by advance technique.
2. Illustrate amplification of variations by advance technique of PCR used in microbiology.
3. Do detection and Characterization of bacterial pathogen by advance technique.
4. Learn about the use of advance technique of molecular biology in bacterial pathogen screening and diagnosis of Blood and Blood Product.
5. Learn about additional screening tools of laboratory diagnosis in pathogen detection in the Genomic Era.

Course Contents

UNIT-I **16 Hours**

Rapid Antigen Tests, Advanced Antibody Detection, Phenotypic Testing of Bacterial Antimicrobial Susceptibility, Biochemical Profile-Based Microbial Identification Systems, Rapid Bacterial Characterization and Identification by MALDI-TOF Mass Spectrometry, Probe-Based Microbial Detection and Identification, Pulsed-Field Gel Electrophoresis, In Vitro Nucleic

UNIT-II **14 Hours**

Acid Amplification: An Introduction, PCR and Its Variations, Non–Polymerase Chain Reaction Mediated Target Amplification Techniques, Recent Advances in Probe Amplification Technologies, Signal Amplification Techniques: bDNA, Hybrid Capture,

UNIT-III **13 Hours**

Agarose Gel Electrophoresis: Detection and Characterization of Molecular Amplification Products: Agarose Gel Electrophoresis, Southern Blot Hybridization,

Restriction Enzyme Digest Analysis, and Enzyme-Linked Immunoassay, Direct Nucleotide Sequencing for Amplification Product Identification, Microarray-Based Microbial Identification and Characterization, Diagnostic Microbiology Using Real-Time PCR Based on FRET Technology

UNIT-IV **17 Hours**

Bacterial Identification Based on 16S Ribosomal RNA Gene Sequence Analysis, Molecular Techniques for Blood and Blood Product Screening, Review of Molecular Techniques for Sexually Transmitted Diseases Diagnosis, Advances in the Diagnosis of Mycobacterium tuberculosis and Detection of Drug Resistance, Bead-Based Flow Cytometric Assays: A Multiplex Assay Platform with Applications in Diagnostic Microbiology, Molecular Strain Typing Using Repetitive Sequence–Based PCR, Pathogen Detection in the Genomic Era

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. XIANG Y. HAN, **Automated Blood Cultures, Advanced Techniques in Diagnostic Microbiology**, pp 3-10
2. Sihe Wang, Xiaotian Zheng, **Urea Breath Tests for Detection of Helicobacter pylori,** Advanced Techniques in Diagnostic Microbiology, pp 11-22
3. Jaber Aslanzadeh, **Biochemical Profile-Based Microbial Identification Systems,**Advanced Techniques in Diagnostic Microbiology pp 84-116
4. Diane Dare, **Rapid Bacterial Characterization and Identification by MALDI-TOF Mass Spectrometry,** Advanced Techniques in Diagnostic Microbiology pp 117-133
5. Tao Hong, **Probe-Based Microbial Detection and Identification,** Advanced Techniques in Diagnostic Microbiology, pp 134-142
6. Fann Wu, Phyllis Della-Latta, **Pulsed-Field Gel Electrophoresis,** Advanced Techniques in Diagnostic Microbiology, pp 143-157
7. Raymond P. Podzorski, Mike Loeffelholz, Randall T. Hayden, **Detection and Characterization of Molecular Amplification Products: Agarose Gel**

Electrophoresis, Southern Blot Hybridization, Restriction Enzyme Digest Analysis, and Enzyme-Linked Immunoassay, Advanced Techniques in Diagnostic Microbiology, pp 243-263

8. Xuan Qin, **Diagnostic Microbiology Using Real-Time PCR Based on FRET Technology**, Advanced Techniques in Diagnostic Microbiology, pp 291-305

Semester: 2nd

Course Title: First Aid

Course Code: MML203

L	T	P	Cr
2	0	0	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Provide First Aid for emergency conditions

2 Demonstrate the techniques of assessing life saving measures for any casualty

3 Explain First Aid management for respiratory problems, injuries, circulatory problems

4 Provide First Aid measures for foreign objects, poisoning bits and stings

5 Identify and give First Aid treatment in community emergencies and natural disorders

Course Contents

UNIT-I **10 Hours**

First aid: Aims and objectives of first aid; wounds and bleeding, dressing and bandages; pressure and splints, supports etc. Shock; insensibility; asphyxia; convulsions; resuscitation, use of suction apparatus; drug reactions; prophylactic measures; administration of oxygen; electric shock; burns; scalds; hemorrhage; pressure points; compression band.

UNIT-II **05 Hours**

Fractures; splints, bandaging; dressing, foreign bodies; poisons.

UNIT-III **07 Hours**

Infection: Bacteria, their nature and appearance; spread of infections; auto-infection or cross-infection; the inflammatory process; local tissue reaction, general body reaction; ulceration; Asepsis and antisepsis. Universal precautions, hospital acquired infections- HIV, Hepatitis B, C, and MRSA etc.

UNIT-IV **08 Hours**

Principles of Asepsis: Sterilization - methods of sterilization; use of central sterile supply department; care of identification of instruments, surgical dressings in common use, including filament swabs, elementary operating theatre procedure; setting of trays and trolleys in the radio imaging department

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. The authorized manual of St. John Ambulance, St. Andrew's Ambulance association and the British red cross society, First Aid manual, 9th edition, Dorling Kindersley, London
2. American college of emergency physicians, First Aid manual, 5th edition, Dorling Kindersley, London
3. Clement Text book on First Aid & Emergency Nursing, First edition, JP brothers, 2012
4. Philip Jevon, Emergency care and First Aid for Nurses, A practical guide, Churchill Living Stone, 2007

Semester: 2nd

Course Title – Fitness and Health Management

L	T	P	Cr.

Course Code: MML204

4	0	0	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Understand the modern concept of Fitness and Health management.
2. Develop competencies for profile development, exercise guidelines adherence.
3. Apply the fitness and wellness management techniques.
4. Analyze intermediate postures and will develop strength, endurance and increased flexibility.
5. Acquire knowledge and demonstrate skills to safely engage in physical activity.

Course Contents

UNIT-I **08 Hours**

Introduction

Meaning and definition"of physical fitness, physical fitness concepts and techniques.

Principles of physical fitness, physiological principles involved in human movement. Components of Physical Fitness. Leisure time physical activity and identify opportunities in the community to participate in this activity.

Current trends in fitness and conditioning, components of total health fitness and the relationship between physical activity and lifelong wellness.

UNIT-II **06 Hours**

Nutrients: Nutrition labeling in formation, food choices, food guide pyramid, Influences on food choices social, economic, cultural, food sources.

Comparison of food values. Weight management, proper practices to maintain, lose and gain.

Eating disorders, proper hydration, and the effects of performance enhancement drugs.

UNIT-III **08 Hours**

Aerobic Exercise

Cardio respiratory endurance training: Proper movement forms, i.e., correct stride, arm movements.

Body alignment: Proper warm-up, cool down and stretching, monitoring heart rates during activity.

Assessment of cardio respiratory fitness and set goals to maintain or improve fitness levels.

Cardio respiratory activities including i.e. power walking, pacer test, interval training, incline running, distance running, aerobics and circuits.

UNIT-IV **08 Hours**

Anaerobic exercise

Resistance training for muscular strength and endurance, principles of resistance training.

Safety techniques (spotting, proper body alignment, lifting techniques, spatial, awareness. And proper breathing techniques).

Weight training principles and concepts, basic resistance exercises (including freehand exercise, free weight exercise, weight machines, exercise bands and tubing. Medicine balls, fit balls) advanced techniques of weight training

Flexibility training, relaxation techniques and core training. Safety techniques (stretching protocol; breathing and relaxation techniques) types of flexibility exercises (i.e. dynamic, static), Develop basic competency in relaxation and breathing techniques. Pilates, Yoga.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Miller, D. K., & Allen, T. E. (1990). *Fitness: A lifetime commitment*. Macmillan Publishing Company.

2. Course, P. B. P. Part A: Theoretical Course. *Education*, *30*(70), 100.

3. Part, A. Course: Master of Physical Education (MP Ed) Semester–I. *Education*, *3*, 3.

4. Heindel, J. J., & Blumberg, B. (2019). Environmental obesogens: mechanisms and controversies. *Annual review of pharmacology and toxicology*, *59*, 89-106.

5. Education, P. SCHEME OF EXAMINATION MP ED. COURSE MP ED. SEMESTER–I. *Education*, *30*(70), 100.

Semester: 2nd

Course Title: Clinical Biochemistry

Course Code: MML205

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Understand biomolecules, metabolism and inborn errors of metabolism.

2 Recall various organ function tests and their significance in result interpretation.

3 Correlate the knowledge of patho-physiology of organ system and hormonal imbalance.

4 Apply biochemical changes involved in various clinical conditions associated with glands and organs of human body.

5 Identify deficiency disease and their correlate conditions including interpretations.

Course Contents

UNIT-I **12 Hours**

Biomolecules :Introduction to carbohydrates and their functions, metabolic reactions of carbohydrates, introduction to lipids and their functions, metabolic reactions of lipids, introduction to proteins and their functions, metabolic reactions of proteins

Inborn errors of metabolism: Inborn errors of carbohydrate metabolism, Inborn errors of lipid metabolism, Inborn errors of protein metabolism, inborn errors of amino acid metabolism: phenyl ketonuria, alkeptonuria, albinism, cystinuria, inborn errors of carbohydrate metabolism: Glycogen storage disease.

UNIT-II **13 Hours**

Biochemical changes in diseases: Biochemistry of diabetes mellitus, fatty liver its cause and symptoms, biochemical changes involved in fatty liver, atherosclerosis and biochemical changes involved

Organ function tests 1: Liver function tests, functions of Liver, Metabolic functions, excretory functions, protection and detoxification, diseases of Liver, principle and clinical importance of liver markers

UNIT-III **09 Hours**

Organ function tests 2 :Formation of urine, excretory and reabsorptive functions, regulatory functions, homeostasis, introduction to disease of kidney, kidney profile test, blood urea nitrogen, serum creatinine, total protein, albumins, globulins, A/G ratio., clearance tests, urine examination, Thyroid gland structure and functions, production of thyroid hormones, types of hyper and hypothyroidism, Hashimoto's disease and Grave's disease, thyroid function test

UNIT-IV **11 Hours**

Malnutrition disorders: Marasmus, kwashiorkor, nutritional deficiency of vitamins& minerals, prescribed diet, hypervitaminosis and hypovitaminosis

Cancer: Etiology of cancer, biochemical changes of cancer, role of oncogenes, apoptosis, biochemical basis of metastasis.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

SUGGESTED READINGS/ REFERENCE BOOKS/ REFERENCES:

Suggested Readings

1. Champe, P. C., Harvey, R. A., & Ferrier, D. R. (2005). Biochemistry. Lippincott Williams & Wilkins.
2. Ferrier, D. R. (2014). Biochemistry. Lippincott Williams & Wilkins.
3. Varley, H. (1954). Practical clinical biochemistry. Practical clinical biochemistry.
4. Lucock, M. (2000). Folic acid: nutritional biochemistry, molecular biology, and role in disease processes. Molecular genetics and metabolism, 71(1-2), 121-138.
5. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2008). Lehninger principles of biochemistry. Macmillan.

6. Vasudevan, D. M., Sreekumari, S., & Vaidyanathan, K. (2013). Textbook of biochemistry for medical students. JP Medical Ltd.

Semester: 2nd

Course Title: Clinical Haematology

Course Code: MML206

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Perform routine hematological tests and collection of specimens, reception and labeling and recording of laboratory investigations.

2 Learn blood cell formation and its composition, factor affecting production of blood cells, Preparation of smears and staining for diagnostic purposes.

3 Understand working, maintenance and calibration of cell counters.

4 Perform hematological testing for diagnosis, internal quality control, external quality control, standardization of instruments.

5 Prepare anticoagulants and their uses in various investigations.

Course Contents

UNIT-I **10 Hours**

Blood: its composition, function and formation, Haematopoiesis and hematopoietic tissue (bone marrow, spleen, liver, thymus, lymph nodes, Red and yellow haematopoietic marrow). Mechanism of haemopoiesis, erythropoiesis, leucopoiesis (Granulopoiesis, monopoiesis, lymphopoiesis and thrombopoiesis) .Role of haemopoietic growth factors.

UNIT-II **12 Hours**

RBC (composition, maturation and developmental stages) RBC metabolism, red cell enzymes. Erythropoietin and its function Haemoglobin, function, structure, types, variants of haemoglobin, acquired abnormal hemoglobinsy. Heme synthesis,

Intravascular & extravascular hemolysis. Total, absolute and differential count, ESR, Platelet count, Reticulocyte count.

UNIT-III **11 Hours**

Leucocytes, its type, morphology and function, Maturation and developmental stages of Neutrophil, Eosinophil, Basophil, Monocytes and Lymphocytes.

Anticoagulants (its mechanism, advantages and disadvantages). Effect of storage on blood cell, Blood collection method, Vacationer, its type, uses and advantages. Bleeding and clotting time

UNIT-IV **12 Hours**

Platelets, its maturation and developmental stages its functions and structure of platelets .Primary and Secondary homeostasis. Coagulation factors, physical & chemical properties of factors, coagulation cascade, coagulation inhibitory system & fibrinolysis.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Wintrobe, M. M. (1962). Clinical hematology. *Academic Medicine*, *37*(1), 78.
2. Bain, B. J., Bates, I., & Laffan, M. A. (2016). *Dacie and lewis practical haematology e-book*. Elsevier Health Sciences.
3. Robbins, S. L. (2002). *Pocket companion to Robbins pathologic basis of disease*. Elsevier Health Sciences TW.
4. Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
5. Godkar, P. B., & Godkar, D. P. (2003). *Textbook of medical laboratory technology*. Bhalani.
6. Sood, R. (2009). *Concise Book of Medical Laboratory Technology: Methods and Interpretations*. Jaypee Brothers Medical Publishers (P) Limited.
7. Mukherjee, K. L. (2010). *Med Lab Tech Vol 1, 2/e*. Tata McGraw-Hill Education.

8. Kolhatkar, A., Ochei, J., & McGraw, T. (2008). Medical Laboratory Science: Theory and Practice.
9. Kawthalkar, S. M. (2012). *Essentials of haematology*. JP Medical Ltd.

Semester: 2nd

Course Title: Research Proposal

Course Code: MML207

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Have Introduction to Research proposal and its various aspects
2 Study about Ethical problems in Research and Research design
3 Know about various research tools.
4 Understand Ethical issues in Research
5 Analyze the different research problems.

UNIT-I **16 Hours**

Research methodology: Introduction to research methods, identifying the research problem

UNIT-II **14 Hours**

Ethical issues: Ethical issues in research, research design

UNIT-III **13 Hours**

Research sample: Collection of relevant data: sampling methods

UNIT-IV **17 Hours**

Construction of study: Construction of study: population, sample, normality and its beyond (not design of study, perhaps)

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

Semester: 2nd

Course Title: Advanced Techniques in Bacteriology Laboratory

Course Code: MML208

L	T	P	Cr.
0	0	4	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Characterize and Identify bacterial pathogen present in samples.

2 Illustrate morphology, biochemical reactions, to differentiate bacterial biomarkers.

3 Differentiate bacterial pathogen screening by using screening tool.

4 Perform deferent -2 screening test of diagnosis.

5 Learn about additional screening tools of laboratory diagnosis cancer.

List of Practical / Experiments

- To characterized bacterial pathogen directly in clinical specimens.
- To diagnose ovarian cancer with HE-4 marker.
- To diagnose ovarian cancer with CA125 marker.
- To diagnose early stage of ovarian cancer.in serum with CA124 assay.
- To diagnose prostate, lung, colorectal, ovarian cancer by High Grade Serious Carcinoma (HGCS) multimodality screening.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Magdalena Elwira Zokowska, (2021). “Advanced methods of bacteriological identification in clinical microbiology laboratory” J. Pre Clin Clin Res. 15 (2) 68-72.

2. V. Dochez, H Callion, E. Vaucel, J Dimet, (2019), Biomarkers and algorithms for diagnosis of ovarian cancer: CA125, HE4, RMI and ROMA – A review Journal of Ovarian

3. K. Al Musahi, M Al Kindi, F Al Aisary (2016) “Evaluation of HE4, CA-125, risk of ovarian malignancy algorithm (ROMA) and risk of malignancy index (RMI) in the preoperative assessment of patiens with adnexal.

Semester-II

Course Title: Advanced Techniques in Microbiology Laboratory

Course Code: MML209

L	T	P	Cr.
0	0	4	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Know about gene cloning, recombinant DNA technology, recombinant proteins expressions.

2 Understand about quality control in molecular techniques etc.

3 Identify properties of good vectors to make DNA library.

4 Perform gene cloning, restriction endonucleases, recognition sequences, isolation and identification of desired gene/clone.

5 Analyze recombinant proteins and its production in other organisms.

List of Practical /Experiments

To prepare bacterial smear and perform simple staining using methylene blue

To perform Gram staining of different bacterial cultures

To perform endospore staining and Albert's staining of bacterial cultures

To perform viable count of bacteria using pour plating technique

To study the effect of pH on the growth of microorganisms

To study the effects of UV radiation on growth of microorganisms

SUGGESTED READINGS/ REFERENCE BOOKS/ REFERENCES:

1. XIANG Y. HAN, **Automated Blood Cultures, Advanced Techniques in Diagnostic Microbiology**, pp 3-10
2. Sihe Wang, Xiaotian Zheng, **Urea Breath Tests for Detection of Helicobacter pylori,** Advanced Techniques in Diagnostic Microbiology, pp 11-22

3. Jaber Aslanzadeh, **Biochemical Profile-Based Microbial Identification Systems,**Advanced Techniques in Diagnostic Microbiology pp 84-116
4. Diane Dare, **Rapid Bacterial Characterization and Identification by MALDI-TOF Mass Spectrometry,** Advanced Techniques in Diagnostic Microbiology pp 117-133
5. Tao Hong, **Probe-Based Microbial Detection and Identification,** Advanced Techniques in Diagnostic Microbiology, pp 134-142
6. Fann Wu, Phyllis Della-Latta, **Pulsed-Field Gel Electrophoresis,** Advanced Techniques in Diagnostic Microbiology, pp 143-157
7. Raymond P. Podzorski, Mike Loeffelholz, Randall T. Hayden, **Detection and Characterization of Molecular Amplification Products: Agarose Gel Electrophoresis, Southern Blot Hybridization, Restriction Enzyme Digest Analysis, and Enzyme-Linked Immunoassay,** Advanced Techniques in Diagnostic Microbiology, pp 243-263
8. Xuan Qin, **Diagnostic Microbiology Using Real-Time PCR Based on FRET Technology**, Advanced Techniques in Diagnostic Microbiology, pp 291-305

Semester: 3rd

Course Title: Virology and Mycology

Course Code: MML301

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Understand various properties of virus, pathogen city, and transmission of virus.

2 Cultivate virus and purification of virus strains,

3 Develop various testing kits for detection the presence of virus in samples.

4 Learn about classification of fungi, media used for culturing fungi.

5 Apply molecular techniques used for the diagnosis of fungal infection.

Course Contents

UNIT-I **14 Hours**

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

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-II **16 Hours**

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

Pathogenicity, clinical features, laboratory diagnosis, immune prophylaxis and prophylaxis: Dengue, Japanese encephalitis, Yellow fever, Kyasanur forest disease, Polio, Influenza virus, Rubella virus, Hepatitis, HIV, Smallpox, Rabies, Rotavirus and Oncovirus

UNIT-III **16 Hours**

Introduction to medical mycology: Introduction and classification of fungi, media used for culturing fungi, chemotherapeutic agents for fungi, mechanism of resistance of chemotherapeutic agents

Pathogen city, clinical features and laboratory diagnosis of superficial and subcutaneous mycosis: Dermatophytoses, Piedra, Tineanigra, Tinea versicolor, chromoblastomycosis, mycetoma, sporotrichosis and rhinosporidiosis

UNIT-IV **14 Hours**

Pathogenicity, clinical features and laboratory diagnosis of systemic mycosis and opportunistic mycosis: Paracoccidioidomycosis, coccidiodomycosis, histoplasmosis, blastomycosis, cryptococcosis candidiasis, aspergillosis, penicillosis

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

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

SUGGESTED READINGS/ REFERENCE BOOKS/ REFERENCES:

Suggested Readings

1. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's textbook of microbiology*. Orient Blackswan
2. Panjarathinam, R. (2007). *Medical microbiology*.New Age International.
3. Kumar, S. (2012). *Textbook of microbiology*. JP Medical Ltd.
4. Willey, J. M., Sherwood, L., &Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.
5. Tortora, G. J., Funke, B. R., & Case, C. L. (2007). *Microbiology: an introduction* (p. 912). San Francisco, CA: Pearson Benjamin Cummings.
6. Lederberg, J. (2000). *Encyclopedia of microbiology, four-volume set.*Academic Press.
7. Mahon, C. R., Lehman, D. C., &Manuselis, G. (2018). *Textbook of diagnostic microbiology-e-book*.Elsevier Health Sciences.
8. Procop, G. W., Church, D. L., Hall, G. S., &Janda, W. M. (2020). *Koneman's color atlas and textbook of diagnostic microbiology*.Jones& Bartlett Publishers.

Semester: 3rd

Course Title: Parasitology and Mycology

Course Code: MML302

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Understand basic morphology, life cycle, pathogenesis, lab diagnosis and treatment of parasites and fungi.

2 Learn basic principle and procedures of isolation of fungus and parasites from clinical sample like stools, vaginal swab.

3 Perform appropriate laboratory techniques used in the processing of specimens and identification of parasites and fungi

4 Learn about the identification of pathogenic parasite and fungus in disease diagnosis and treatment

5 Analyze various laboratory techniques used in processing of specimens and identification of parasites and fungi

Course contents

UNIT-I **12 Hours**

General Parasitology-Classification of medically important parasites, epidemiology of parasitic infections, immunology of human parasitic infections. Diagnostic parasitology- Systematic study of parasites (Geographical distribution, habitat, morphology and life cycle, risk of infection, pathogenesis, laboratory diagnosis prophylaxis and serological diagnosis)Intestinal amoeba, free living pathologic amoeba, Giardia, trichomonas, balantidium, isospora, cryptosporidium, microspora, cyclospora Plasmodia, leishmania, trypanasoma, toxoplasma, babesia

UNIT-II **11 Hours**

Helminthes– Cestodes – Taenia, Echinococus, Diphylobothrium, Hymenolepsis, Multiceps, Trematodes- Schistosoma, Fasciola, Fasciolepsis, Paragonimus, Clonorchis, Opisthorchis. Nematodes- Ascaris, Hookworm (Ancylostoma), Trichuris, Enterobius, Strongyloides, Filaria, Trichinella, Toxocara, Dracunculus, Biological vectors

UNIT-III **12 Hours**

General Mycology – Fungus – Classification Fungal Structure & Morphology, Reproduction in fungi, Immunity to Fungal Infections. Culture Media in Mycology, Stains in Mycology. Diagnostic Mycology - Epidemiology, Pathogenesis, Laboratory Diagnosis of Fungal Infections. Specimen collection, preservation, Transportation & Identification of Mycological Agent.

UNIT-IV **10 Hours**

Biochemical tests– Tests for fungal identification, Anti-fungal agents, in vitro tests. Serological tests for mycotic infections. Use of laboratory animals in Mycology. Typing of fungi Preparation of fungal antigens & their standardization.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's textbook of microbiology*. Orient Blackswan
2. Panjarathinam, R. (2007). *Medical microbiology*. New Age International.
3. Kumar, S. (2012). *Textbook of microbiology*. JP Medical Ltd.
4. Willey, J. M., Sherwood, L., & Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.
5. Tortora, G. J., Funke, B. R., & Case, C. L. (2007). *Microbiology: an introduction* (p. 912). San Francisco, CA: Pearson Benjamin Cummings.
6. Lederberg, J. (2000). *Encyclopedia of microbiology, four-volume set*. Academic Press.
7. Mahon, C. R., Lehman, D. C., & Manuselis, G. (2018). *Textbook of diagnostic microbiology-e-book*. Elsevier Health Sciences.
8. Procop, G. W., Church, D. L., Hall, G. S., & Janda, W. M. (2020). *Koneman's color atlas and textbook of diagnostic microbiology*. Jones & Bartlett Publishers.

Semester: 3rd

Course Title: General Pathology and Terminology

Course Code: MML303

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Learn basic definitions and terminology used in pathology.
2 Understand the study of oncology and different types of oncogenes.
3 Explain various Tissues factors and their repair
4 Have knowledge of DNA repair genes and their nomenclature.
5 Analyze different types of deficiency diseases of vitamins and minerals

Course contents

UNIT–I **11 Hours**

Introduction & History of pathology : Basic definitions and familiarization with the common terms used in pathology, Causes and mechanisms of cell injury, reversible and irreversible injury, Introduction of hyperplasia, hypoplasia, hypertrophy, atrophy, metaplasia, necrosis and apoptosis

UNIT–II **13 Hours**

Cancer: Definitions, nomenclature, characteristics of benign and malignant neoplasm, metastasis, Carcinogens and cancer, concept of oncogenes, tumour suppressor genes, DNA repair genes and cancers stem cells

UNIT – III **09 Hours**

Tissue Renewal and Repair: Healing and fibrosis, cirrhosis, introduction of oedema, hyperemia, congestion, haemorrhage, haemostasis, thrombosis, embolism, infarction, shock and hypertension .General features of acute and chronic inflammation: Vascular changes, cellular events, Cells and mediators of inflammation, Phagocytosis and its mechanism

UNIT – IV **12 Hours**

Protein energy malnutrition: Deficiency diseases of vitamins and minerals, nutritional excess and imbalances. Role and effect of metals (Zinc, Iron and Calcium) and their deficiency diseases, Aetiology and pathophysiology of diabetes, arteriosclerosis, myocardial infarction, respiratory diseases (COPD), Parkinson disease Infectious Diseases: pathogenesis & overview of modes of infections, prevention and control with suitable examples like Typhoid, Dengue.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
2. Bancroft, J. D., & Gamble, M. (Eds.). (2008). *Theory and practice of histological techniques*. Elsevier health sciences.
3. Culling, C. F. A., Allison, R. T., & Barr, W. T. (2014). *Cellular pathology technique*. Elsevier.
4. Mohan, H. (2015). *Textbook of pathology*. Jaypee Brothers Medical Publishers.
5. Mohan, H. (2012). *Pathology practical book*. JP Medical Ltd.
6. Culling, C. F. A. (2013). *Handbook of histopathological and histochemical techniques: including museum techniques*. Butterworth-Heinemann.

Semester: 3rd

Course Title: Histopathology and Cytology

Course Code: MML304

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Understand histopathology and various histotechniques.
2. Recall tissue and its types.
3. Have knowledge of microtome and it's working.
4. Prepare sections of fresh,fixed and unfixed tissues.
5. Analyze tissue processing and general staining

Course contents

UNIT–I **11 Hours**

Introduction Introduction to histopathology, cytology & histotechniques. Laboratory organization, care & maintenance of equipment's used in histotechnology lab. Safety measures in histotechnology lab.Recording, Labelling and transportation of tissue specimens. Basic concepts of fixation and various types of fixative used in histopathology and cytopathology.

Unit–II **11 Hours**

Tissue and its types- Location and function, Grossing of tissues, whole mount, sections, smears, tissue processing and its steps, manual and automated method, components & principle of automatic tissue processor. Decalcification methods, types of decalcifying fluid, Processing of bones and teeth, Embedding media, its type and properties.

Unit–III **11 Hours**

Microtome- Type of microtome and working. Microtome knives (type and knife sharpening). Section cutting, fault and remedies, Section adhesive. Use of control sections in tissue staining, mounting and mounting media, advantages &disadvantages,

Unit–IV **12 Hours**

Cryostat sectioning - Cryostat sectioning and frozen sections of fresh, fixed and unfixed tissue, freeze drying, rapid frozen sections and staining for emergency diagnosis. Dye chemistry, stains and dyes, (natural dye, acidic dye, basic dye, neutral dyes, fluorescence dye).

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Bancroft's Theory and Practice of Histological Techniques, 7th Edition, Elsevier Publications
2. Harshmohan (2017), Textbook of Pathology,7th edition, Jaypee Publications
3. Godkar.B. Praful,(2016) Textbook of MLT,3rd edition,Bhalani Publications
4. C F A Culling,(1974),Handbook of Histopathological and Histochemical Techniques: Including Museum Techniques,3rd edition, Butterworth

Semester: 3rd

Course Title: Bio-Medical Waste Management

Course Code: MML305

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Learn the concept of Bio-medical Waste management
2. Understand the planning and objective of BMW
3. Recall the technologies used for the treatment of BMW
4. Prepare planning and objectives for BMW Management
5. Analyze the risk factors and legal aspects related to BMW Management

Course Contents

UNIT-I **12 Hours**

Present Scenario of Bio-medical waste – Concepts and Perceptions, Waste Generation, Segregation, Disposal

UNIT-II **12 Hours**

Planning and Objectives of BMW Management -Survey, Policies and Perspectives of BMW Management

UNIT-III **11 Hours**

Management of Bio-medical Waste- Record Keeping, Technologies for Treatment for BMW, Criteria for selecting appropriate Medical Waste Technologies

UNIT-IV **10 Hours**

Legal Aspects and Environment Concern -Training, Occupational Safety and Health Issues, Implementation of Action Plan, Approaches to Common Regional facility

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. The Book of Hospital Waste Management: Dr. D.B. Acharya & Dr. Meeta Singh (Minerva Press, New Delhi)
2. Hospital Waste Management & its Monitoring: Madhuri Sharma (Jaypee Brothers, Medical

Semester: 3rd

Course Title: Medical Laboratory Management and Medical Ethics

Course Code: MML306

L	T	P	Cr.
0	0	2	1

Total Hours 15

Course Content

UNIT-I **10 Hours**

Ethical Principles and standards for a clinical laboratory professional: Duty to the patient, colleagues, other professionals and towards the society

Good Laboratory Practice Regulations and Accreditation: Introduction to Basics & aims of GLP and Accreditation and its advantages, Brief knowledge about Nation and International Agencies for clinical laboratory accreditation.

UNIT-II **05 Hours**

Awareness / Safety in a clinical laboratory: General safety precautions, Pre- and Post-exposure (HIV, Hepatitis B &C), Drug Resistant Tuberculosis.
Biomedical Waste Management, Calibration and Validation of Clinical Laboratory instruments

UNIT-III **10 Hours**

Patient Management: Patient management for clinical samples collection, collection of sample, transportation and preservation, Sample accountability, Sample analysis, Reporting result

Quality Management system: Introduction, Quality assurance, Quality control system

UNIT-IV **05 Hours**

Ethics in Medical laboratory: Understanding the term 'Ethics', Ethics in relation to the following: Pre-Examination procedure, Examination procedures, Reporting of results, Preserving medical records**,** Access to Medical laboratory Records

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Wintrobe, M. M. (1962). Clinical hematology. *Academic Medicine*, *37*(1), 78.
2. Bain, B. J., Bates, I., & Laffan, M. A. (2016). *Dacie and lewis practical haematology e-book*. Elsevier Health Sciences.
3. Robbins, S. L. (2002). *Pocket companion to Robbins pathologic basis of disease*. Elsevier Health Sciences TW.
4. Kumar, V., Abbas, A. K., & Aster, J. C. (2017). *Robbins basic pathology e-book*. Elsevier Health Sciences.
5. Godkar, P. B., & Godkar, D. P. (2003). *Textbook of medical laboratory technology*. Bhalani.
6. Sood, R. (2009). *Concise Book of Medical Laboratory Technology: Methods and Interpretations*. Jaypee Brothers Medical Publishers (P) Limited.
7. Mukherjee, K. L. (2010). *Med Lab Tech Vol 1, 2/e*. Tata McGraw-Hill Education.

8. Kolhatkar, A., Ochei, J., & McGraw, T. (2008). Medical Laboratory Science: Theory and Practice.
9. Kawthalkar, S. M. (2012). *Essentials of haematology*. JP Medical Ltd.

Semester: 3rd

Course Title: Innovation and Entrepreneurship

Course Code: MML307

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Learn Entrepreneur and Entrepreneurship
2 Understand project finding and new enterprises.
3 Recall various opportunities in Small business
4 Analyze legal requirement for setting up a business unit
5 List various problems of Entrepreneurs.

Course Contents

UNIT-I **12 Hours**

Entrepreneur and entrepreneurship: Definition, traits and features, classification; Women entrepreneurs, Role of entrepreneur in India. Create an awareness about EDP. Entrepreneurial development programme concept. Need for trainning, phases of EDP, curriculum & contents of Training Programme.

UNIT-II **11 Hours**

General Awareness about project financing and new enterprises: Promotion of a venture, opportunity. Analysis Project identification and selection, External environmental analysis economic, social, technological an competitive factors. Legal requirements for establishment of a new unit, loans. Over rum finance, Bridge finance; Venture capital. Providing finance in approaching financing institutions for loans.

UNIT-III **11 Hours**

To identify different Discuss opportunities in small business: Small business Enterprise - Identifying the Business opportunity in various sectors - formalities for

setting up of a small business enterprise - Institutions supporting small business enterprise - EDII (Entrepreneurship Development Institute of India), SLDO (Small Industries Development Organization NSIC (National small Industries Corporation Ltd. (CNSIC) . NIESBUD (National Institute for Entrepreneurship and small Business Development) Sickness in small business enterprise causes and remedies.

UNIT-IV **11 Hours**

To understand about a project report relating to a small business Project formulation - Meaning of a project report significance contents formulation planning commissions guidelines for formulating a project report - specimen of a project report, problems of entrepreneurs ,case studies of entrepreneurs.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Cliffton, Davis S. and Fylie, David E. , Project Feasibility Analysis, John Wiley, New York, 1977.•
2. Desai A. N., Entrepreneur and Environment, Ashish, New Delhi, 1990.•
3. Drucker, Peter, Innovation and Entrepreneurship, Heinemann, London, 198•
4. Jain Rajiv, Planning a Small Scale Industry: A guide to Entrepreneurs, S. S. Books, Delhi, 1984 Kumar S. A. , Entrepreneurship in Small Industry, Discovery, New Delhi, 1990
5. McCleffand, D. C. and Winter, W. G. , Motivating Economic Achievement, Free Press, New York, 19

Semester: 3rd

Course Title: Virology and Mycology Laboratory

Course Code: MML308

L	T	P	Cr.
0	0	4	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Understand various procedures for diagnosis of various viruses, fungal organism from samples.

2 Perform staining techniques for identification of fungi.

3 Prepare culture media for isolation of fungi from various samples.

4 Collect samples from skin, nail, and hairs, for identification of fungal agent.

5 Isolate and identify Candida sp. and perform germ tube test.

Course Contents

List of Practical's / Experiments:

- To perform serodiagonosis of HIV infection kit by tridot kit.
- To perform serodiagnosis of Hepatitis B by cassette method.
- To perform staining of fungi by lacto phenol cotton blue
- To isolate and identify fungi from skin sample.
- To isolate and identify fungi from hair sample.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Ananthanarayan, R. (2006). *Ananthanarayan and Paniker's textbook of microbiology*. Orient Blackswan
2. Panjarathinam, R. (2007). *Medical microbiology*. New Age International.
3. Kumar, S. (2012). *Textbook of microbiology*. JP Medical Ltd.
4. Willey, J. M., Sherwood, L., & Woolverton, C. J. (2011). *Prescott's microbiology* (Vol. 7). New York: McGraw-Hill.
5. Tortora, G. J., Funke, B. R., & Case, C. L. (2007). *Microbiology: an introduction* (p. 912). San Francisco, CA: Pearson Benjamin Cummings.
6. Lederberg, J. (2000). *Encyclopedia of microbiology, four-volume set*. Academic Press.
7. Mahon, C. R., Lehman, D. C., & Manuselis, G. (2018). *Textbook of diagnostic microbiology-e-book*. Elsevier Health Sciences.
8. Procop, G. W., Church, D. L., Hall, G. S., & Janda, W. M. (2020). *Koneman's color atlas and textbook of diagnostic microbiology*. Jones & Bartlett Publishers.

Semester: 3rd

Course Title: Parasitology and Mycology Laboratory

L	T	P	Cr.
0	0	4	2

Course Code: MML309

Total Hours 30

List of Practical's / Experiments:

- To perform routine microscopic examination of stool for parasitic infections.
- To perform parasitic examination of stool for by physical and chemical method.
- To perform parasitic microscopic examination of sputum.
- To isolate and identify Candida species by germ tube test.
- To isolate and identify fungi from nail sample.
- To isolate and identify the morphology of mould by slide culture technique.

Suggested Readings

1. Chatterjee, K. D. (2018). *Parasitology: protozoology and helminthology*. CBS Publishers & Distributors Pvt Ltd.
2. Arora, B., & Arora, D. R. (2007). *Practical microbiology*. CBS Publishers & Distributors.
3. Paniker, C. J. (2007). *Textbook of medical parasitology* (No. Ed. 6). Jaypee Brothers Medical Publishers (P) Ltd.
4. John, D. T., & Petri, W. A. (2013). *Markell and Voge's medical parasitology-e-book*. Elsevier Health Sciences

Semester: 3rd

Course Title: Clinical Visit

L	T	P	Cr.
0	0	4	2

Course Code: MML310

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1. Clinical visits provide opportunities for students to develop and refine these technical skills under the supervision of experienced laboratory professionals.
2. Clinical visits provide hands-on experience in maintaining a safe and controlled laboratory environment.

3. Clinical visits expose students to quality assurance practices, allowing them to observe and participate in activities related to quality management in a real-world setting.
4. Clinical visits provide opportunities for students to encounter real-life scenarios and challenges in the laboratory.
5. Clinical visits provide an environment for students to develop interpersonal skills, including clear and concise communication, teamwork, and empathy towards patients and colleagues.
6. Clinical visits offer opportunities for students to observe and adhere to these responsibilities in practice.
7. Clinical visits require students to manage their time effectively and prioritize tasks within a laboratory setting.

List of Practical's / Experiments:

1. Log-book of Practical's/ Experiments:
2. Clinical Visit: Hospital and Laboratory Visits

Semester: 3rd

Course Title: Soft Skill and Personality Development

Course Code: MML311

L	T	P	Cr.
2	0	0	2

Total Hours 30

Course Learning Outcomes: On completion of this course, the successful students will be able to

1 Provide First Aid for emergency conditions
2 Demonstrate the techniques of assessing life saving measures for any casualty
3 Explain First Aid management for respiratory problems, injuries, circulatory problems
4 Provide First Aid measures for foreign objects, poisoning bits and stings
5 Identify and give First Aid treatment in community emergencies and natural disorders

Course Contents

UNIT-I **06 Hours**

Listening Skills: Barriers to listening; effective listening skills; feedback skills. Attending telephone calls, note taking. Activities: Listening exercises - Listening to conversation, News and TV reports. Taking notes on a speech / lecture.

UNIT-II **09 Hours**

Speaking and Conversational Skills: Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics. The study of sounds of English, stress and intonation. Situation based Conversation in English.

UNIT-III **08 Hours**

Essentials of Spoken English: Activities, Making conversation and taking turns, Oral description or explanation of a common object, situation or concept, giving interviews.

UNIT-IV **07 Hours**

Oral Presentation with / without audio visual aids. Group Discussion. Listening to any recorded or live material and asking oral questions for listening comprehension.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question

Suggested Readings

1. Covey, S. R. (1991). *The seven habits of highly effective people*. Provo, UT: Covey Leadership Center.
2. Galanes, G. J., Adams, K. H., & Brilhart, J. K. (2007). *Effective group discussion: Theory and practice.*McGraw-Hill.
3. Hargie, O. (Ed.). (1997). *The handbook of communication skills*. Psychology Press.
4. Kurtz, S., Silverman, J., Draper, J., van Dalen, J., & Platt, F. W. (2017). *Teaching and learning communication skills in medicine*. CRC press.
5. Downing, J. E. (2005). Teaching communication skills. *Baltimore, MD: Paul H. Brookes*.
6. McCabe, C., & Timmins, F. (2013). *Communication skills for nursing practice*. Macmillan International Higher Education.
7. Soft skills Training - A workbook to develop skills for employment by Fredrick H. Wentz
8. Personality Development and Soft skills Oxford University Press by Barun K. Mitra.

Semester: 4th

Course Title: Dissertation

Course Code: MML401

L	T	P	Cr.
NA	NA	NA	20

Total Hours 300

Students have to carry out a research project (on any topic related to laboratory) under the supervision of a faculty. The Dissertation has to be prepared on the basis of the research work carried out. The assessment is done on the basis of the work done, the presentation and viva.

ACADEMIC INSTRUCTIONS

Attendance Requirement

A student shall have to attend 75% of the scheduled periods in each course in a semester; otherwise, he / she shall not be allowed to appear in the end semester examination of that course and shall be detained in the course(s). The University may condone attendance shortage in special circumstances as specified by the authority. A student detained in the course(s) would be allowed to register in the detained course(s) when offeredby the department in next odd/even semester.

Evaluation of different type of courses will be as under:

<table>
<tr><th colspan="8">Evaluation Criteria for Theory Courses</th></tr>
<tr><td>Assignments</td><td>PPT Presentations</td><td>Surprise Tests</td><td>Attendance</td><td>MST 1</td><td>MST 2</td><td>ESE</td><td>Total Marks</td></tr>
<tr><td>2 N</td><td>2 N</td><td>3N</td><td>-</td><td>1N</td><td>1N</td><td>1N</td><td>-</td></tr>
<tr><td>5 Marks</td><td>5 Marks</td><td>5 Marks</td><td>5 Marks</td><td>20 Marks</td><td>20 Marks</td><td>40 Marks</td><td rowspan="2">100</td></tr>
<tr><td colspan="6">60</td><td>40</td></tr>
</table>

- Two Assignments (One in the third week and one in the Ninth week)
- Two PPTs (during fourth and eighth week)
- Three surprise tests (One before each MST and one before ESE)

Evaluation Criteria for Practical courses						
Hands on work	Practical Record	Surprise Practical	Attendance	EST of Practical	Viva	Total Marks
40 Marks	10 Marks	10 Marks	05 Marks	20	15	100

Evaluation Criteria for Dissertation/Project /Internship	
Internal Presentation	50 Marks
External Presentation	50 Marks
Total	100 Marks

The internal presentation will be conducted by the concerned Schools/departments. In the external presentation the Dean of the School will propose a panel of external examiners and one examiner will be selected by the Vice Chancellor

The evaluation committee will comprise of Dean of the School, supervisor, external examiner and Head of the Department.

In case of Dissertation, Dean Research will also be the member of evaluation committee.