Curriculum and Syllabi

Bachelor of Science in Medical Laboratory Technology

Batch 2023 - 2027

Bachelor of Science in Medical Laboratory

Technology (B. Sc. MLT)

Adamas University

School of Medical Sciences

Department of Allied Health Sciences

(Effective from Academic Session 2023 – 2024)

Adamas University

Kolkata, West Bengal – 700126

Introduction

Objectives/aim of the course:

1. Proficiently perform a full range of clinical laboratory tests

2. Develop and evaluate test systems and interpretive algorithms

3. Manage information to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information

Expectation from the future graduate in providing patient care:

At the end of the course the student should be able to:

1. Perform routine clinical laboratory testing.

2. Make specimen-oriented decisions on predetermined criteria including working knowledge of critical values.

3. Communicate with other members of healthcare team, customers and patients in an effective manner.

4. Process information and ensure quality control as appropriate to routine laboratory procedures.

5. Train students in routine laboratory procedure.

6. Upgrade knowledge and skills in a changing healthcare scenario.

7. Should know the logical interpretation of clinical lab investigations.

8. Should be able to extrapolate data acquired.

9. Should be able to working on automated machine.

Program educational objectives (PEOs):

PEO1 To build a strong theoretical knowledge base along with necessary practical skill and able to use these experiences in clinical land medical laboratory technology and its research & development in hospitals and in academia.

PEO2 To provide student s with a strong foundation in Biochemistry, Pathology, Biological sample analysis and waste disposal as per the present requirement of diagnostic Industries, Comm unity and Hospital Pathological department

PEO3 To train students with good knowledge along with practical efficiency in biochemical and analytical aspects in research and design. Extend this knowledge to provide full-fledged support to medical staff in hospital for the benefit a patient

The expected outcomes of the Program are:

PO1	Apply knowledge and technical skills associated with medical laboratory technology for delivering quality clinical investigations support.

PO2	Perform routine clinical laboratory procedures within acceptable quality control parameters in Haematology, Biochemistry, Immunohaematology and Microbiology.
PO3	Demonstrate technical skills, social behaviour and professional awareness for functioning effectively as a laboratory technician.
PO4	Apply problem solving techniques in identification and correction of pre analytical, post analytical & analytical variables.
PO5	Operate and maintain laboratory equipment utilizing appropriate quality control and safety procedures.
PO6	Recognize the impact of laboratory tests in a global and environmental context.
PO7	Communicate effectively by oral, written and graphical means.
PO8	Function as a leader / team member in diverse professional and industrial research areas.
PO9	Apply the fundamentals of research process to complete and present research studies that enrich the field of laboratory technology.
PO10	Function in an ethical and professional manner without bias against any ethnicity, race, religion, caste or gender.
PO11	Practice professional and ethical responsibilities with high degree of credibility, integrity and social concern.

The expected outcomes of the Specific Program are: (up to 3)

PSO1	To build a strong theoretical knowledge base along with necessary practical skill and able to use these experiences in clinical and medical laboratory technology and its research & development in hospitals and in academia.
PSO2	To provide student s with a strong foundation in Biochemistry, Pathology, Biological sample analysis and waste disposal as per the present requirement of diagnostic Industries, Comm unity and Hospital Pathological department.
PSO3	To train students with good knowledge along with practical efficiency in biochemical and analytical aspects in research and design. Extend this knowledge to provide full-fledged support to medical staff in hospital for the benefit a patient.

Eligibility for admission

Selection procedure

1. Candidate should have passed 10 + 2 with Physics, Chemistry, Mathematics/Biology.

2. Minimum percentage of marks: As per the policy of Adamas University.

Provision of Lateral Entry:

Students who have successfully completed DMLS/DMLT and would like to pursue B.Sc. MLT can directly enter into the second year or 3rd Semester, subject to availability of vacancy/ syllabus evaluation by the department.

Duration of the course

Duration of the course: Total 04 Years (08 semesters) with 3 and half years didactic and + 6 months internship.

Medium of instruction

English shall be the medium of instruction for all the subjects of study and for examination of the course.

Provision of internship & project

Six months of internship should be mandatory in a government recognized Hospital/Institution as partial fulfillment for the award of Bachelor in MLT Degree to candidates, as per government norms. Minimum 720 hours of internship should be completed by the candidate to be awarded the degree.

Attendance

Students need to attend regular theory and practical class. Attendance as per the policy of Adamas University. 75% attendance is mandatory in all theory and practical papers during the semester. **No relaxation, whatsoever, will be permissible to this rule under any ground including** indisposition **etc.**

Assessment:

Assessments should be completed by the academic teaching staff, based on the compilation of the student ‘s theoretical & clinical performance throughout the training program. Assessment will be as per the policy of Adamas University as well as Policy of Examination of Adamas University.

Program Structure

Subjects for first semester

Course Title	Course Code	Credit	Continuous and Comprehensive Assessment Maximum Marks - Mandatory	End Semester Maximum Marks – Mandatory	Subject Total Work
Medical Terminology, Record keeping	MLT41101	2	50	50	100
Medical Law and Ethics	MLT41103	2	50	50	100
Introduction to Quality and Patient safety	MLT41105	2	50	50	100
Introduction to National Healthcare Delivery in India	MLT41107	2	50	50	100
Principals of Management with special reference to Medical Laboratory Science (MLS) management	MLT41109	2	50	50	100
Basic Computer and Information Science	MLT41111	2	50	50	100
Basic Computer and Information Science - Lab	MLT41207	2	50	50	100
Communication and Soft Skills	MLT41117	2	50	50	100
Communication and Soft Skills	MLT41211	1	50	50	100
Professionalism and Values	MLT41113	1	50	50	100
Environmental Science	MLT41115	1	50	50	100
Community orientation and clinical visit	MLT41213	1	50	50	100
Medical Terminology, Record keeping - Lab	MLT41201	1	50	50	100
Introduction to Quality and Patient safety - Lab	MLT41203	2	50	50	100
Environmental Science - Lab	MLT41209	1	50	50	100
Principals of Management with special reference to Medical Laboratory Science (MLS) management - Lab	MLT41205	2	50	50	100
Total		**26 Credits**			

Subjects for second semester

Course Title	Course Code	Credit	Continuous and Comprehensive Assessment Maximum Marks - Mandatory	End Semester Maximum Marks – Mandatory	Subject Total Work
General Clinical Microbiology	MLT41102	4	50	50	100
Basic Haematology	MLT41104	4	50	50	100
Human Anatomy and Physiology	MLT41106	4	50	50	100
Basic Clinical Biochemistry	MLT41108	4	50	50	100
General Clinical Microbiology - (Lab)	MLT41202	2	50	50	100
Basic Haematology - (Lab)	MLT41204	2	50	50	100
Human Anatomy and Physiology (Lab)	MLT41206	2	50	50	100
Basic Clinical Biochemistry - (Lab)	MLT41208	2	50	50	100
Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical	MLT41210	2	50	50	100
Total		**26 Credits**			

Subjects for third semester

Course Title	Course Code	Credit	Continuous and Comprehensive Assessment Maximum Marks - Mandatory	End Semester Maximum Marks – Mandatory	Subject Total Work
Systematic Bacteriology	MLT42101	4	50	50	100
Basics of Haematological diseases	MLT42103	4	50	50	100
Biochemical Metabolism	MLT42105	4	50	50	100
Fundamentals of Histology	MLT42107	4	50	50	100
Systematic Bacteriology- (Lab)	MLT42201	2	50	50	100

Basics of Hematological diseases - (Lab)	MLT42203	2	50	50	100
Biochemical metabolism - (Lab)	MLT42205	2	50	50	100
Fundamentals of Histology - (Lab)	MLT42207	2	50	50	100
Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical	MLT42209	2	50	50	100
Total		**26 Credits**			

Subjects for fourth semester

Course Title	**Course Code**	**Credit**	**Continuous and Comprehensive Assessment Maximum Marks - Mandatory**	**End Semester Maximum Marks – Mandatory**	**Subject Total Work**
Applied Bacteriology	MLT42102	4	50	50	100
Applied Haematology – I	MLT42104	4	50	50	100
Analytical Clinical Biochemistry	MLT42106	4	50	50	100
Applied Histopathology – I	MLT42108	4	50	50	100
Applied Bacteriology- (Lab)	MLT42202	2	50	50	100
Applied Haematology - I - (Lab)	MLT42204	2	50	50	100
Analytical Clinical Biochemistry - (Lab)	MLT42206	2	50	50	100
Applied Histopathology - I - (Lab)	MLT42208	2	50	50	100
Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical	MLT42210	2	50	50	100
Total		**26 Credits**			

Subjects for fifth semester

Course Title	Course Code	Credit	Continuous and Comprehensive Assessment Maximum Marks - Mandatory	End Semester Maximum Marks – Mandatory	Subject Total Work
Immunology & Bacterial serology	MLT43101	4	50	50	100
Applied Haematology – II	MLT43103	4	50	50	100
Applied Clinical Biochemistry – I	MLT43105	4	50	50	100
Applied Histopathology - II	MLT43107	4	50	50	100
Immunology & Bacterial serology -(Lab)	MLT43201	2	50	50	100
Applied Haematology - II -(Lab)	MLT43203	2	50	50	100
Applied Clinical Biochemistry - I- (Lab)	MLT43205	2	50	50	100
Applied Histopathology-II -(Lab)	MLT43207	2	50	50	100
Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical	MLT43209	2	50	50	100
Total		**26 Credits**			

Subjects for sixth semester

Course Title	Course Code	Credit	Continuous and Comprehensive Assessment Maximum Marks - Mandatory	End Semester Maximum Marks – Mandatory	Subject Total Work
Medical Parasitology & Entomology	MLT43102	4	50	50	100
Advanced Haematology	MLT43104	4	50	50	100
Applied Clinical Biochemistry - II	MLT43106	4	50	50	100
Cytopathology	MLT43108	4	50	50	100

Medical Parasitology & Entomology - (Lab)	MLT43202	2	50	50	100
Advanced Haematology - (Lab)	MLT43204	2	50	50	100
Applied Clinical Biochemistry - II-(Lab)	MLT43206	2	50	50	100
Cytopathology - (Lab)	MLT43208	2	50	50	100
Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical	MLT43210	2	50	50	100
Total		**26 Credits**			

Subjects for seventh semester

Course Title	**Course Code**	**Credit**	**Continuous and Comprehensive Assessment Maximum Marks - Mandatory**	**End Semester Maximum Marks – Mandatory**	**Subject Total Work**
Medical Mycology and Virology	MLT44101	4	50	50	100
Blood Banking & Genetics	MLT44103	4	50	50	100
Immunopathology & Molecular Biology	MLT44105	4	50	50	100
Research methodology and Biostatistics	MLT44107	4	50	50	100
Medical Mycology and Virology - (Lab)	MLT44107	2	50	50	100
Blood Banking & Genetics-(Lab)	MLT44203	2	50	50	100
Immunopathology & Molecular Biology - (Lab)	MLT44205	2	50	50	100
Research methodology and Biostatistics - (Lab)	MLT44207	2	50	50	100
Guest Lecture/Tutorial/Seminar/visit to any medical research institution or reputed clinical	MLT44209	2	50	50	100
Total		**26 Credits**			

Subjects plan for eighth semester

Course Title	Course Code	Credit	Continuous and Comprehensive Assessment Maximum Marks - Mandatory	End Semester Maximum Marks – Mandatory	Subject Total Work
Internship	MLT44202	26 Credits			
Total		**26 Credits**			

Total credits: 208

YEAR – I

SEMESTER – I

COURSE TITLE: MEDICAL TERMINOLOGY, RECORD KEEPING

COURSE CODE: MLT41101

COURSE CREDIT: 2

CONTACT HOURS: 30

Rationale: This subject introduces the elements of medical terminology. Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes and suffixes. Topics include: origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study. Spelling is critical and will be counted when grading tests. The students will be oriented to the role of a medical laboratory professional in the healthcare system, and the scope, purpose and career opportunities in the field of medical laboratory science.

Course Objectives:

- ✓ This subject introduces the elements of medical terminology.
- ✓ Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes.
- ✓ Topics include origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study.
- ✓ Spelling is critical and will be counted when grading tests.
- ✓ The students will be oriented to the role of medical laboratory professional in healthcare system, scope, purpose, career opportunities in Medical Laboratory science.
- ✓ They will also be introduced to healthcare system and public health in India.

Course Outcomes:

- ➢ CO1: Identify, pronounce, and spell medical terms.
- ➢ CO2: Use terms in context; utilize prefixes, suffixes, root words, and plurals to construct medical terms.
- ➢ CO3: Analyse medical terms.
- ➢ CO4: Translate abbreviation and interpret symbols.
- ➢ CO5: Demonstrate ability to analyse words by dividing them into component parts.

Module I: Basics of medical terminology

1. Derivation of medical terms
2. Define word roots, prefixes and suffixes
3. Conventions for combined morphemes and the formation of plurals
4. Basic medical terms
5. Form medical terms by utilizing roots, suffixes, prefixes and combining roots

Module II: Abbreviation related to health system

6. Interpret basic medical abbreviations/symbols

7. Utilize diagnostic, surgical, and procedural terms and abbreviations related to the integumentary system, musculoskeletal system, respiratory system, cardiovascular system, nervous system, and endocrine system

Module III: Medical record keeping

8. Interpret medical orders/reports

9. Data entry and management on electronic health record system

Suggested reading: An introduction to Med. Lab. Technology by F.J. Baker & R.E. Silverton, Pb. London Butterworth and Co. Ltd.

COURSE TITLE: MEDICAL LAW AND ETHICS

COURSE CODE: MLT41103

COURSE CREDIT: 2

CONTACT HOURS: 30

Rationale: Legal and ethical considerations are firmly believed to be an integral part of medical practice in planning patient care. Advances in medical Science, growing sophistication of the modern society's legal framework, increasing awareness of human rights and changing moral principles of the community at large, now result in frequent occurrences of healthcare professionals being caught in dilemmas over aspects arising from daily practice.

Course Objectives:

- ✓ The goal is "to improve the quality of patient care by identifying, analysing, and attempting to resolve the ethical problems that arise in practice".
- ✓ Physicians are bound by, not just moral obligations, but also by laws and official regulations that form the legal framework to regulate medical practice. Hence, it is now a universal consensus that legal and ethical considerations are inherent and inseparable parts of good medical practice across the whole spectrum.

Course Outcomes:

- ➢ CO1: Apply local, state, and central standards and regulations for the control and use of health information.
- ➢ CO2. Demonstrate appropriate health information disclosure practices.
- ➢ CO3. Identify and discuss ethical issues in health care.
- ➢ CO4. Define general legal terms as they apply to the practice of medicine in ambulatory care settings.
- ➢ CO5. Differentiate between sources and types of law.
- ➢ CO6. Identify the role of the medical assistant/Technician/Technologist.

Module I: Introduction to Medical ethics

1. Medical ethics - Definition - Goal - Scope

2. Introduction to Code of conduct

3. Basic principles of medical ethics – Confidentiality

Module II: Autonomy and consent in healthcare

4. Malpractice and negligence - Rational and irrational drug therapy

5. Autonomy and informed consent - Right of patients

6. Care of the terminally ill- Euthanasia

7. Organ transplantation

Module III: Medico legal aspects of medical records

8. Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects.

9. Professional Indemnity insurance policy

Module IV: Ethics & guidelines in the profession of Medical Laboratory Science

10. Development of standardized protocol to avoid near miss or sentinel events

11. Obtaining an informed consent.

12. Ethics in the profession of Medical Laboratory Science

Suggested readings: 1. Medical Law and Ethics by Bonnie F Fremgen 2. Medical Law and Ethics by Herring 3. Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, Rachna Agarwal, Sujata Chaturvedi and Rajiv Thakur

COURSE TITLE: INTRODUCTION TO QUALITY AND PATIENT SAFETY

COURSE CODE: MLT41105

COURSE CREDIT: 2

CONTACT HOURS: 30

Rationale: The subject will introduce the students to understand the basic concepts of quality in health Care and develop skills to implement sustainable quality assurance program in the health system. It will sensitize students in basic emergency care, Infection prevention & control with knowledge of Bio-medical waste management and Antibiotic resistance.

Course Objectives:

- ✓ The basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system.
- ✓ It will sensitize them in basic emergency care, infection prevention & control with knowledge of biomedical waste management and antibiotic resistance.

Course Outcomes:

- ➢ CO1: Explain the national policy, regulatory, and advocacy pressures to improve patient safety and quality of care.
- ➢ CO2: Identify organizational structures and processes designed to improve quality and patient safety.
- ➢ CO3: Describe the role of accountability and how it is used to guide costs, quality and outcomes.
- ➢ CO4: Explain strategies designed to increase the use of evidence-based patient safety interventions.
- ➢ CO5: Analyse the relationship between patient safety organizational culture and communication that influences patient outcomes.
- ➢ CO6: Explain strategies for building a business case for improving safety.

Module I: Quality assurance and management

1.1 Concepts of Quality of Care

1.2 Quality Improvement Approaches

1.3 Standards and Norms

1.4 Quality Improvement Tools

1.5 Introduction to NABH guidelines

Module II: Basics of emergency care and life support skills

2.1 Vital signs and primary assessment

2.2 Basic emergency care – first aid and triage

2.3 Ventilations including use of bag-valve-masks (BVMs)

2.4 Choking, rescue breathing methods

2.5 One- and Two-rescuer CPR

2.6 Using an AED (Automated external defibrillator).

2.7 Managing an emergency including moving a patient

Module III: Bio medical waste management and environment safety

3.1 Definition of Biomedical Waste

3.2 Waste minimization

3.3 BMW – Segregation, collection, transportation, treatment and disposal (including color coding)

3.4 Liquid BMW, Radioactive waste, Metals / Chemicals / Drug waste

3.5 BMW Management & methods of disinfection

3.6 Modern Technology for handling BMW

3.7 Use of Personal protective equipment (PPE)

3.8 Monitoring & controlling of cross infection (Protective devices)

Module IV: Infection prevention and control

4.1 Evidence-based infection control principles and practices [such as Sterilization, Disinfection, Effective hand hygiene and use of Personal Protective Equipment (PPE)],

4.2 Prevention & control of common healthcare associated infections,

4.3 Components of an effective infection control program, and

4.4 Guidelines (NABH and JCI) for Hospital Infection Control

Module V: Antibiotic Resistance

5.1 History of antibiotics

5.2 How resistance happens and spreads

5.3 Types of resistance- intrinsic, acquired, passive

5.4 Trends in drug resistance

5.5 Actions to fight resistance

5.6 Bacterial persistence

5.7 Antibiotic sensitivity

5.8 Consequences of antibiotic resistance

5.9 Antimicrobial Stewardship – Barriers and opportunities, tools and models in hospitals

Module VI: Disaster preparedness and management

6.1 Fundamentals of emergency management,

6.2 Psychological impact management,

6.3 Resource management,

6.4 Preparedness and risk reduction,

6.5 Key response functions (including public health, logistics and governance, recovery, rehabilitation and reconstruction), information management, incident command and institutional mechanisms.

Suggested reading: Textbook of Medical Laboratory Technology, Praful B. Godkar, Darshan P. Godkar.

COURSE TITLE: INTRODUCTION TO NATIONAL HEALTHCARE DELIVERY IN INDIA

COURSE CODE: MLT41107

COURSE CREDIT: 2

CONTACT HOURS: 30

Rationale: The course provides the students a basic insight into the main features of the Indian health care delivery system and how it compares with the other systems of the world. **Course Objectives:**

- ✓ The course provides the students a basic insight into the main features of Indian health care delivery system and how it compares with the other systems of the world.

Course Outcomes:

- ➢ CO1: Describe the health systems of various Countries including India.

- CO2: Discuss and learn public health care system in India.
- CO3: Develop, implement, and manage various public health programs.
- CO4: Critically analyse the various components of health care delivery system in India.

Course Contents

Module I: Introduction to healthcare delivery system

1.1. Healthcare delivery system in India at primary, secondary and tertiary care

1.2. Community participation in healthcare delivery system

1.3. Health system in developed countries.

1.4. Private Sector

1.5. National Health Mission

1.6. National Health Policy

1.7. Issues in Health Care Delivery System in India

Module II. National Health Programmes

Background objectives, action plan, targets, operations, achievements and constraints in various National Heath Programmes.

Module III: Introduction to AYUSH system of medicine:

Introduction to Ayurveda b. Yoga and Naturopathy c. Unani d. Siddha e. Homeopathy f. Need for integration of various systems of medicine

Module IV: Health scenario of India

Past, present and future. Public health in India (epidemiology and demography)

Module V: Demography & Vital Statistics

5.1. Demography – its concept

5.2. Vital events of life & its impact on demography

5.3. Significance and recording of vital statistics

5.4. Census & its impact on health policy

Module VI: Epidemiology

6.1. Principles of Epidemiology

6.2. Natural History of disease

6.3. Methods of Epidemiological studies

6.4. Epidemiology of communicable & non-communicable diseases, disease transmission,

host defence immunizing agents, cold chain, immunization, disease monitoring and surveillance.

COURSE TITLE: PRINCIPALS OF MANAGEMENT WITH SPECIAL REFERENCE TO MEDICAL LABORATORY SCIENCE (MLS) MANAGEMENT

COURSE CODE: MLT41109

COURSE CREDIT: 2

CONTACT HOURS: 30

Rationale: The students will be made aware of the basic ethics, good lab practices including awareness/ safety in a clinical lab. In addition, they will be made to understand Sample accountability, Quality Management system, biomedical waste management, Calibration and Validation of Clinical Laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial Management.

Course Objectives:

- ✓ 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, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

Course Outcomes:

- ➢ CO1: Students will be able to identify different levels of management, leadership and administrative qualities.
- ➢ CO2: Disciples will learn about different type of staff requirement in lab, their jobs and responsibilities, performance, validation of new equipment.
- ➢ CO3: Upon learning the different laboratory hazards, students will be able to manage the laboratory safety accordingly.

Course Contents

Module I: Ethical Principles and standards for a clinical laboratory professional

1.1. Duty to the patient

1.2. Duty to colleagues and other professionals

1.3. Duty to the society

Module II: Good Laboratory Practice (GLP) Regulations and Accreditation

2.1. Introduction to Basics of GLP and Accreditation

2.2. Aims of GLP and Accreditation

2.3. Advantages of Accreditation

2.4. Brief knowledge about National and International Agencies for clinical laboratory accreditation

Module III: Awareness / Safety in a clinical laboratory

3.1. General safety precautions

3.2. HIV: pre- and post-exposure guidelines

3.3. Hepatitis B & C: pre- and post-exposure guidelines

3.4. Drug Resistant Tuberculosis

Module IV: Patient management

4.1. Patient management for clinical samples collection, transportation and preservation, sample accountability

4.2. Purpose of accountability

4.3. Methods of accountability

Module V: Sample analysis

5.1. Introduction

5.2. Factors affecting sample analysis

Module VI: Reporting results

6.1. Basic format of a test report

6.2. Reported reference range

6.3. Clinical Alerts

6.4. Abnormal results

6.5. Turnaround time

6.6. Results from referral laboratories

6.7. Release of examination results

6.8. Alteration in reports

Module VII: Quality Management system

7.1. Introduction

7.2. Quality assurance

7.3. Quality control system

7.4. Internal and External quality control

Module VIII: Biomedical waste management in a clinical laboratory

Module IX: Introduction and importance of calibration and Validation of Clinical Laboratory instruments

Module X: Introduction to Laboratory Information system (LIS)

Hospital Information system (HIS) and financial management

Module XI: Ethics in Medical laboratory Practice

11.1 Introduction

11.2 Functions of a laboratory management system

11.3 Standards for laboratory management system

11.4 Introduction and awareness of financial management in a clinical laboratory

12. Inventory Control

Suggested reading: Medical Laboratories Management- Cost effective methods by Sangeeta Sharma, Rachna Agarwal, Sujata Chaturvedi and Rajiv Thakur

COURSE TITLE: BASIC COMPUTER AND INFORMATION SCIENCE

COURSE CODE: MLT41111

COURSE CREDIT: 2

CONTACT HOURS: 30

Rationale: The students will be able to appreciate the role of computer technology. The course deals with computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation.

Course Objective:

- ✓ The students will be able to appreciate the role of computer technology. The course focuses on computer organization, computer operating system and software, and MS windows, Word processing, Excel data worksheet and PowerPoint presentation. Topics to be covered under the subject are as follows:

Course Outcomes:

- CO1: Understanding the concept of input and output devices of Computers and how it works and recognize the basic terminology used in computer programming.
- CO2: Write, compile and debug programs in C language and use different data types for writing the programs.
- CO3: Design programs connecting decision structures, loops and functions.
- CO4: Explain the difference between call by value and call by address.
- CO5: Understand the dynamic behavior of memory by the use of pointers.
- CO6: Use different data structures and create / manipulate basic data files and developing applications for real world problems.

Course Contents

Module I: Introduction to computers

1. Introduction, characteristics of computers, block diagram of computers, generations of computers, computer languages

Module II: Input output devices

2. Input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), output devices (monitors, pointers, plotters, screen image projector, voice response systems)

Module III: Processor and memory

3. Central Processing Unit (CPU), main memory

Module IV: Storage Devices

4. Sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices

Module V: Introduction of windows

5. History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.)

Module VI: Introduction to MS-Word

6. Introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spell checking, printing the document file, creating and editing of table, mail merge

Module VII: Introduction to Excel

7. Introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs

Module VIII: Introduction to PowerPoint

8. Introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs

Module IX: Introduction of Operating System

9. Introduction, operating system concepts, types of operating system

Module X: Computer networks

10. Introduction, types of networks (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network

Module XI: Internet and its Applications

11. Definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet, Application of Computers in clinical settings

Suggested Readings: 1. Information technology by Anshuman Sharma (Lakhanpal Publisher) 2. Computer Fundamentals (Concepts. Systems and applications) by P. K. Sinha (University of Tokyo, Japan) BPB Publications

COURSE TITLE: PROFESSIONALISM AND VALUES

COURSE CODE: MLT41113

COURSE CREDIT: 1

CONTACT HOURS: 15

Rationale: The module on professionalism will deliver the concept of what it means to be a professional and how a specialized profession is different from a usual vocation. It also explains how relevant is professionalism in terms of healthcare system and how it affects the overall patient environment.

Course Objective:

- ✓ Students will understand the importance of Values and Ethics in their Personal lives and professional careers. The students will learn the rights and responsibilities.

Course Outcomes:

- CO1: Understanding basic purpose of profession, professional ethics and various moral and social issues.
- CO2: Awareness of professional rights and responsibilities of a Engineer, safety and risk benefit analysis of a Engineer.
- CO3: Acquiring knowledge of various roles of Engineer in applying ethical principles at various professional.

Course Contents

Module I: Professional values

Integrity, Objectivity, Professional competence and due care, Confidentiality

Module II: Personal values

Ethical or moral values

Module III: Attitude and behavior

Professional behavior, treating people equally

Module IV: Code of conduct

Professional accountability and responsibility, misconduct

Module V: Team efforts

Differences between professions and importance of team efforts

Module 6. Cultural issues

Cultural issues in the healthcare environment

Suggested Readings 1. R. R. Gaur, R Sangal, GP Bagaria, 2009, a Foundation Course in Value Education. 2. E.F. Schumacher, 1973, Small is Beautiful: A study of Economics as if people mattered, Blond & Briggs, Britain. 3. A. Nagraj, 1998, Jeevan Vidyaek Parichay, Divya Path Sansthan, Amarkantak. 4. P.L. Dhar, R. R. Gaur, 1990, Science and Humanism, Common wealth Publishers. 5. A.N. Tripathy, 2003, Human Values, New Age International Publishers 6. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press 7. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.

COURSE TITLE: ENVIRONMENTAL SCIENCE

COURSE CODE: MLT41115

COURSE CREDIT: 1

CONTACT HOURS: 15

Rationale: The student will be made aware of our environment in general, Natural Resources, Ecosystems, Environmental Pollution, and social issues related to environment, Human Population and the Environment and understanding the Hospital Environment.

Course Objective:

- ✓ The student will be made aware of the environment in general, natural resources, ecosystems, environmental pollution, and social issues related to environment, human population and the environment and understanding the hospital environment.

Course Outcomes:

- ➢ CO1: Student will be able to identify different dimensions of environmental studies; problems related to the environmental degradation & will be able to take remedial steps.
- ➢ CO2: Disciples will learn about different type of disaster that occur in nature consequently learning to develop the preparedness and remedial techniques.
- ➢ CO3: Upon learning the problems related to environmental waste, students will be able to segregate the waste in different categories and will learn its effective management techniques.

Course Contents

Module I: Introduction

1. Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness.

Module II: Natural Resources

2. Natural Resources and associated problems, use and over exploitation, case studies of forest resources and water resources.

Module III: Ecosystems

3. Concept of Ecosystem, Structure, interrelationship, producers, consumers and decomposers, ecological pyramids-biodiversity and importance. Hotspots of biodiversity

Module IV: Environmental Pollution

4. Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards

4.1 Solid waste management: Causes, effects and control measure of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

4.2 Social blemishes and the Environment From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, water shed management Resettlement and rehabilitation of people; its pros and concerns.

4.3 Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

4.4 Case studies, Wasteland reclamation.

4.5 Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation public awareness.

4.6 Human Population and the Environment, Population growth, variation among nations. Population explosion–Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies.

Module V: Understanding the Hospital Environment

Module VI: Understanding the environment in the following clinical laboratories

6.1 Microbiology

6.2 Biochemistry

6.3 Histopathology

6.4 Haematology

Module VII: Clinical laboratory hazards to the environment from the following and means to prevent

7.1 Infectious material

7.2 Toxic Chemicals

7.3 Radioactive Material

7.4 Other miscellaneous wastes

Suggested Readings 1. Agarwal, K. C. 2001 Environment Biology, Nidi Publ. Ltd. Bikaner. 2. Jadhav, H &Bhosale, V.M. 1995. Environment Protection and Laws. Himalaya Pub House, Delhi 284 p. 3. Rao M. N. &Datta A.K. 1987. Waste water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p. 4. Daniel D. Chiras 2010. Environmental Science. 1st Indian Edition, Jones and Bartlett India Pvt. Ltd. 4262/3, Ansar Road, Daryaganj, New Delhi. 5. Principle of Environment Science by Cunninghan, W.P. 6. Essentials of Environment Science by Joseph. 7. Environment Pollution Control Engineering by Rao, C.S. Model Curriculum Handbook of Medical Laboratory Science (Intellectual property of Ministry of Health and Family Welfare) Page 52 of 189 8. Perspectives in Environmental Studies by Kaushik, A. 9. Elements of Environment Science &Engg. By Meenakshi. 10. Elements of environment Engg. by Duggal.

COURSE TITLE: COMMUNICATION AND SOFT SKILLS
COURSE CODE: MLT41117
COURSE CREDIT: 2
CONTACT HOURS: 30

Rationale: Emphasizing on building basic language skills, this course introduces elements of communication skills using topics like business communication, public speaking, health communication, etc.

Course objective:

- ✓ The course would help students develop an understanding of the skills required to complete their studies effectively. The students would learn how to evaluate sources of information, norms of referencing, plagiarism, and its pitfalls and much more. Above all they would learn to develop a curious mindset and strive for independence. The course will aim at-
- Developing skills for success in academic studies and careers beyond.
- Applying the academic skills to effectively complete their course objectives.
- Developing an inquiring mindset and apply it throughout their course of study.

Course Outcomes:

- CO1: Understand the need for writing skills related to researching, referencing and use of appropriate language in their own area of work.
- CO2: Apply appropriate writing skills learned to various forms of assignment during their course of study.
- CO3: Evaluate their views on plagiarism and its impact on their studies.
- CO4: Develop Critical Thinking Skills for appropriate writing.

Course Contents

Module I: Basic language skills

1. Grammar and Usage

Module II: **Business communication skills**

2. With focus on speaking - conversations, discussions, dialogues, short presentations, pronunciation

Module III: Teaching the different methods of writing

3. The different methods of writing (like letters, e-mails, reports, case studies, basic compositions, journals, collecting and reporting patient data, etc.) with a focus on paragraph form and organization

Module IV:

4. Basic concepts & principles of good communication

Module V:

5. Special characteristics of health communication

Module VI:

6. Types & process of communication

Module VII:

7. Barriers of communication & how to overcome them

COURSE TITLE: MEDICAL TERMINOLOGY, RECORD KEEPING - LAB
COURSE CODE: MLT41201
COURSE CREDIT: 1
CONTACT HOURS: 15
Course Objectives:

- ✓ This subject introduces the elements of medical terminology.
- ✓ Emphasis is placed on building familiarity with medical words through knowledge of roots, prefixes, and suffixes.
- ✓ Topics include origin, word building, abbreviations and symbols, terminology related to the human anatomy, reading medical orders and reports, and terminology specific to the student's field of study.
- ✓ Spelling is critical and will be counted when grading tests.
- ✓ The students will be oriented to the role of medical laboratory professional in healthcare system, scope, purpose, career opportunities in Medical Laboratory science.
- ✓ They will also be introduced to healthcare system and public health in India.

Course Outcomes:

- ➢ CO1: Identify, pronounce, and spell medical terms.
- ➢ CO2: Use terms in context; utilize prefixes, suffixes, root words, and plurals to construct medical terms.
- ➢ CO3: Analyse medical terms.
- ➢ CO4: Translate abbreviation and interpret symbols.
- ➢ CO5: Demonstrate ability to analyse words by dividing them into component parts.

Course Contents
List of Experiments:

1. General discussion/Sensitization on career opportunities and role of MLS in Hospital Care.

2. Visit to Central Sterile Supply Department (CSSD).

3. Visit to incinerator complex.

4. Visit to Immunization section.

5. Visit to working Microbiology, Haematology, Biochemistry and Histopathology laboratories.

COURSE TITLE: INTRODUCTION TO QUALITY AND PATIENT SAFETY - LAB

COURSE CODE: MLT41203

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objectives:

- ✓ The basic concepts of quality in health care and develop skills to implement sustainable quality assurance program in the health system.

- ✓ It will sensitize them in basic emergency care, infection prevention & control with knowledge of biomedical waste management and antibiotic resistance.

Course Outcomes:

- ➢ CO1: Explain the national policy, regulatory, and advocacy pressures to improve patient safety and quality of care.
- ➢ CO2: Identify organizational structures and processes designed to improve quality and patient safety.
- ➢ CO3: Describe the role of accountability and how it is used to guide costs, quality and outcomes.
- ➢ CO4: Explain strategies designed to increase the use of evidence-based patient safety interventions.
- ➢ CO5: Analyse the relationship between patient safety organizational culture and communication that influences patient outcomes.
- ➢ CO6: Explain strategies for building a business case for improving safety.

Course Contents

List of Experiments:

1. **Biomedical waste management:**
   1.1. Types of the waste generated
   1.2. Segregation
   1.3. Treatment
   1.4. Disposal

Suggested readings: 1. Text book of Preventive Medicine by Par and Park for infection prevention and control 2. Text book of Microbiology by Ananthanaryanan for Antibiotic Resistance.

COURSE TITLE: PRINCIPALS OF MANAGEMENT WITH SPECIAL REFERENCE TO MEDICAL LABORATORY SCIENCE (MLS) MANAGEMENT – LAB
COURSE CODE: MLT41205
COURSE CREDIT: 2
CONTACT HOURS: 30

Course Objectives:

- ✓ 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, biomedical waste management, calibration and validation of clinical laboratory instruments, Laboratory Information system (LIS), Hospital Information system (HIS) and financial management.

Course Outcomes:

- ➢ CO1: Students will be able to identify different levels of management, leadership and administrative qualities.
- ➢ CO2: Disciples will learn about different type of staff requirement in lab, their jobs and responsibilities, performance, validation of new equipment.
- ➢ CO3: Upon learning the different laboratory hazards, students will be able to manage the laboratory safety accordingly.

Course Contents

List of Experiments:

List of Experiments:

Clinical sample collection e.g. 1.1 Blood 1.2 Urine 1.3 Stool 1.4 Saliva 1.5 Sputum 1.6 Semen analysis 2. Sample accountability 2.1 Labelling of sample 2.2 Making entries in Laboratory records 3. Reporting results 3.1 Basic format of a test report 3.2 Release of examination results 3.3 Alteration in reports 4. Quality Management system 4.1 Quality assurance 4.2 Internal and External quality control 4.3 Quality improvement 5. Biomedical waste management in a clinical laboratory - Disposal of used samples, reagents and other biomedical waste 6. Calibration and Validation of Clinical Laboratory instruments 7. Ethics in medical laboratory practice in relation to the following: 7.1 Pre-Examination procedures 7.2 Examination procedures 7.3 Reporting of results 7.4 Preserving medical records 7.5 Access to medical laboratory records 8. Audit in a Medical Laboratory -Documentation

Suggested readings: 1. Text book of Preventive Medicine by Par and Park for infection prevention and control 2. Text book of Microbiology by Ananthanaryanan for Antibiotic Resistance

COURSE TITLE: BASIC COMPUTER AND INFORMATION SCIENCE - LAB
COURSE CODE: MLT41207
COURSE CREDIT: 2
CONTACT HOURS: 30
Course Objectives:

- ✓ The computer Applications subject aims to augment students' awareness toward the modern system setups.
- ✓ To enrich their knowledge the smart working processors.
- ✓ To build base for further subjects.

Course Content

List of Experiments:

1. Demonstration of basic hard ware of the computers and laptops

2. Learning to use MS office: MS word, MS PowerPoint, MS Excel.

3. To install different software.

4. Data entry efficiency

COURSE TITLE: ENVIRONMENTAL SCIENCE - LAB

COURSE CODE: MLT41209

COURSE CREDIT: 1

CONTACT HOURS: 15

Course Contents

List of Experiments:

1. Any Activity related to public awareness about the environment: 1.1. Preparation of Charts/Models 1.2. Visit to any effluent treatment plant 1.3. Seeding a plant/s and take care of it/them.

2. Preparation of models/charts in relation to natural resources of drinking water.

3. Preparation of Models of Ecosystem on biodiversity.

4. Effects of environmental pollution on humans through poster presentation.

5. Any Activity related to wild life preservation.

6. Visit to any hospital/ clinical laboratory and understanding the environment therein.

7. Visit to an incinerator.

8. Any activity related to biomedical waste management in a hospital or clinical laboratory

Suggested readings: 1. Text book of Preventive Medicine by Par and Park for infection prevention and control 2. Text book of Microbiology by Ananthanaryanan for Antibiotic Resistance

COURSE TITLE: COMMUNICATION AND SOFT SKILLS- LAB
COURSE CODE: MLT41211
COURSE CREDIT: 1
CONTACT HOURS: 15
Course Content
List of Experiments:

1. Précis writing and comprehension of simple passages from a prescribed text book. The passage should be atleast100 words and students should answer a few questions based on it.

2. To practice all forms of communication i.e., drafting reports, agendas, notes, précis writing, telegrams, circulars, presentations, press releases, telephonic communication, along with practice on writing resumes and applications for employment.

COURSE TITLE: COMMUNITY ORIENTATION AND CLINICAL VISIT
COURSE CODE: MLT41213
COURSE CREDIT: 1
CONTACT HOURS: 15
Rationale: The objective of this particular section of the foundation course is to sensitize potential learners with essential knowledge; this will lay a sound foundation for their learning across the under-graduate program and across their career. Innovative teaching methods should be used to ensure the attention of a student and make them more receptive such as group activities, interactive fora, role plays, and clinical bed-side demonstrations.

Course Content

List of Experiments:

1. The community orientation and clinical visit will include visit to the entire chain of healthcare delivery system -Sub centre, PHC, CHC, SDH, DH and Medical College, private hospitals, dispensaries and clinics.

2. The student will also be briefed regarding governance at village level including interaction and group discussion with village panchayat and frontline health workers.

3. Clinical visit to their respective professional department within the hospital.

YEAR – I

SEMESTER – II

COURSE TITLE: GENERAL CLINICAL MICROBIOLOGY

COURSE CODE: MLT41102

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Medical Microbiology and basic procedures done in a medical microbiology laboratory i.e., microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

Course Objectives:

- ✓ This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Clinical Microbiology and basic procedures done in a medical microbiology laboratory i.e., microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

Course Outcomes:

- ➢ CO1: The student would be able to produce knowledge of bacteria with diagrams.
- ➢ CO2: Student will be able to tell the distinguishing features of prokaryotes and eukaryotes.
- ➢ CO3: Students would have knowledge of different sterilization techniques and microbial preservation.

Course Content:

Module I: Basics of Microbiology

1. Introduction to Medical Microbiology:

1.1 Definition

1.2 History

1.3 Host - Microbe relationship

2. Safety measures in Clinical Microbiology

3. Glassware used in Clinical Microbiology Laboratory:

3.1 Introduction

3.2 Care and handling of glassware

3.3 Cleaning of glassware

3.4 Equipment used in clinical Microbiology Laboratory:

3.4.1 Introduction

3.4.2 Care and maintenance including calibration

Module II: Elementary idea about Microscope

4. Microscopy

4.1 Introduction and history

4.2 Types, principle and operation mechanism of following microscopes

4.2.1 Light microscope

4.2.2 DGI

4.2.3 Fluorescent

4.2.4 Phase contrast

4.2.5 Electron microscope: Transmission/ Scanning

Module III: Sterilization and Disinfection

5. Sterilization:

5.1 Definition

5.2 Types and principles of sterilization methods

5.2.1 Heat (dry heat, moist heat with special Reference to autoclave)

5.2.2 Radiation

5.2.3 Filtration

5.2.4 Efficiency testing to various sterilizers

6. Antiseptics and disinfectants:

6.1 Definition.

6.2 Types and properties

6.3 Mode of action - Uses of various disinfectants

6.4 Precautions while using the disinfectants - Qualities of a good disinfectant

6.5 Testing efficiency of various disinfectants

7. Biomedical waste management in a Medical Microbiology laboratory:

7.1 Types of the waste generated – Segregation – Treatment – Disposal

8. General characteristics & classification of Microbes: (Bacteria &fungi)

8.1 Classification of microbes with special reference to prokaryotes & eukaryotes

8.2 Morphological classification of bacteria

8.3 Bacterial anatomy (Bacterial cell structures)

Module IV: Growth and Culture of Microbes

9. Growth and Nutrition of Microbes:

9.1 General nutritional & other requirements of the bacteria

9.2 Classification of bacteria on the basis of their nutritional requirements

9.3 Physical conditions required for growth.

9.4 Normal growth cycle of bacteria (growth curve)

9.5 Types of microbial cultures: Synchronous, Static, continuous culture.

10. Culture media:

10.1 Introduction

10.2 Classification of culture media (Example & Uses) solid media, liquid media, semisolid, Media, routine/synthetic/defined media, basal media, enriched, enrichment, Selectivedifferential media, sugar fermentation media, transport media, preservation media and anaerobic culture media

10.3 Quality control in culture media

10.4 Automation in culture media preparation

Module V: Aerobic and Anaerobic Culture

11. Aerobic & anaerobic culture methods:

11.1 Concepts

11.2 Methods Used for aerobic cultures

11.3 Methods used for anaerobic cultures

12. Introductions to Immunology

12.1 Immunity

12.2 Antigens and Antibodies

13. Care & handling of laboratory animals:

13.1 Introduction

13.2 General care & handling

13.3 Ethics & legality in use of laboratory animals

Suggested Readings

1. Practical Medical Microbiology by Mackie and McCartney

2. Text book of Microbiology by Ananthanarayan

3. Medical Microbiology by Panikar& Satish Gupte

4. Medical laboratory Technology vol. I, II, III by Mukherjee

5. District Laboratory Practice in tropical countries Vol II Microbiology by Monica Cheesbrough

6. Text book of Microbiology by Prescott

COURSE TITLE: BASIC HAEMATOLOGY

COURSE CODE: MLT41104

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: Students will be made aware of the composition of blood and methods of estimating different components of blood. Students will learn the basic concepts of Haematology& routine clinical investigations of Haematology laboratory.

Course Objectives:

- ✓ Students will be made aware of the composition of blood and methods of estimating different components of blood. Students will learn the basic concepts of Haematology& routine clinical investigations of Haematology laboratory.

Course Outcomes:

- ➢ CO1: Students will know about the components of blood and their staining procedures.
- ➢ CO2: Students will know about the procedures for blood count.
- ➢ CO3: Students will know about the blood banking procedures.

Course Content:

Module I: Introduction to Haematology

1. Introduction to Haematology

1.1 Definition

1.2 Importance

1.3 Important equipment used

2. Laboratory organization and safety measures in Haematology Laboratory

3. Introduction to blood, its composition, function and normal cellular components

4. Anticoagulants: types, mode of action and preference of anticoagulants for different haematological studies

5. Collection and preservation of blood sample for various haematological investigations

Module II: Formation of blood cells

6. Formation of cellular components of blood (Haemopoiesis)

6.1 Erythropoiesis

6.2 Leucopoiesis

6.3 Thrombopoiesis

7. Haemoglobin: definition, types, structure, synthesis and degradation

Module III: Morphology of blood cells

8. Morphology of normal blood cells

9. Normal Haemostasis & physiological properties of coagulation factors

10. Quality assurance in Haematology

11. Internal and external quality control including reference preparation

12. Routine quality assurance protocol

13 Statistical analyses i.e., Standard deviation, Co-efficient of variation, accuracy and precision

Suggested Readings

1. Text book of Medical Laboratory Technology by Praful B. Godkar

2. Medical laboratory Technology by K.L. Mukherjee Volume-I

3. Practical Haematology by J.B. Dacie

4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henry

5. Atlas of Haematology (5th edition) by G.A. McDonald

6. De Gruchy's Clinical Haematology in Medical Practice

COURSE TITLE: HUMAN ANATOMY AND PHYSIOLOGY

COURSE CODE: MLT41106

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: Students will be able to learn the terminology of the subject and basic knowledge of cells, tissues, blood and to understand anatomy and physiology of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

Course Objective:

- ✓ Students will be able to learn the terminology of the subject and basic knowledge of cells, tissues, blood and to understand anatomy and physiology of human body. This subject will develop an understanding of the structure and function of organs and organ systems in normal human body.

Course Outcomes:

- ➢ CO1: Student will know about the divisions of anatomy.
- ➢ CO2: Student will know about the anatomy of cell organelles, tissues, bone, cartilage, joints.

- CO3: Student will have knowledge about the anatomy of the organs of respiratory, cardiovascular and digestive system.
- CO4: Students will have the knowledge about the peritoneum in brief.

Course Content:

Module I: Introduction to human Anatomy and Physiology

1. Introduction to human Anatomy and Physiology

2. Cell and cell organelles

2.1 Structure and classification

2.2 Function

2.3 Cell division (Mitosis and Meiosis)

3. Tissues

3.1 Definition

3.2 Classification with structure and Functions

3.2.1 Epithelial tissues

3.2.2 Connective tissues

3.2.3 Muscular tissues

3.2.4 Nervous tissue

Module II: Blood, Respiration and Cardiovascular System

4. Blood

4.1 Composition

4.2 Function of blood

5. Muscular skeletal system

5.1 Introduction

5.2 Classification

5.3 Structure and function of skeletal system, muscles and joints

5.4 Various movements of body

6. Respiratory system

6.1 Introduction

6.2 Structure

6.3 Function

6.4 Mechanism of breathing and respiration

6.5 Various terms involved in respiratory System

6.5.1 Vital capacity

6.5.2 Total Volume

6.5.3 Reserve volume

6.5.4 Total lung capacity

7. Cardiovascular system

7.1 Anatomy and physiology of heart

7.2 Blood circulation

7.3 Arteries and veins

7.4 Conductive system of heart

7.5 Cardiac cycle

7.6 Introduction to ECG

Module III: Lymphatic System

8. Lymphatic system

8.1 Introduction

8.2 Structure and function

8.2.1 Lymph nodes

8.2.2 Spleen

8.2.3 Thymus gland, Tonsils

9. Structure and function of sense organ

9.1 Eye

9.2 Ear

9.3 Nose

9.4 Tongue

Module IV: Body fluid

10. Body fluids and their significance: Important terms, types of body fluid, total body water,

avenues by which water leaves and enters body, general principles for fluid balance, cardinal principle, how body fluids maintain Homeostasis, Electrolytes & ions Function of electrolytes, how electrolyte imbalance leads to fluid imbalance.

Module V: Digestive System

11. Digestive system: Organization; accessory organs; structure & function (Mouth, Tongue, Teeth, Esophagus, Pharynx, Stomach, Intestine, Rectum, Anus); Digestive glands; physiology of digestion of carbohydrates, lipids & proteins

12. Liver: structure and function

Module VI: Urinary and Genital System

13. Urinary system: Main parts, Structure &function of kidney, structure of nephron, physiology of

excretion & urine formation, urine, additional excretory organs

14. Genital system: Structure of male and female reproductive system, Gametogenesis in male

& female, menstrual cycle. Placenta and extra embryonic membranes.

15. Nervous system: Parts, function & structure; brain, spinal cord, spinal & cranial nerves; all & none principle, role of neurotransmitters in transmission of nerve impulse

16. Endocrine system: Endocrine & exocrine glands, their location, structure & functions

Suggested readings:

1. Anatomy & Physiology- Ross and Wilson

2. Anatomy and Physiology: Understanding the Human Body by Clark

3. Anatomy and Physiology for nurses by Evelyn Pearce

4. Anatomy and Physiology for nurses by Sears

5. Anatomy and Physiology for nurses by Pearson

6. Anatomy and Physiology by N Murges

COURSE TITLE: BASIC CLINICAL BIOCHEMISTRY

COURSE CODE: MLT41108

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The main objective of the subject is to impart the knowledge of apparatus, units, equipment, and volumetric analysis in the laboratory of clinical Biochemistry.

Course Objectives:

- ✓ The main objective of the subject is to impart the knowledge of apparatus, units, equipment, and volumetric analysis in the laboratory of clinical Biochemistry.

Course Outcomes:

- **CO1:** Illustrate the basic principle and techniques to understand the biological problem.
- **CO2:** Identify the physical principles responsible for maintaining the basic cellular function.

- **CO3:** Appraise the importance of various biophysical and biochemical techniques.

Course Content:

Module I: Introduction to Medical Laboratory Technology

1. Introduction to Medical lab. Technology

1.1 Role of Medical lab Technologist

1.2 Ethics and responsibility

1.3 Safety measures

1.4 First aid

2. Cleaning and care of general laboratory glass ware and equipment

2.1 Steps involved in cleaning soda lime glass

2.2 Steps involved in cleaning borosil glass

2.3 Preparation of chromic acid solution

2.4 Storage

3. Distilled water

3.1 Method of preparation of distilled water

3.2 Type of water distillation plants

3.3 Storage of distilled water

Module II: Use of Glassware and Pipettes

4. Units of Measurement.

4.1 S. I unit and CGS units

4.2 Conversion

4.3 Strength, molecular weight, equivalent weight

4.4 Normality, Molarity, Molality

4.5 Numerical

5. Calibration of volumetric apparatus

5.1 Flask

5.2 Pipettes

5.3 Burettes

5.4 Cylinders

6. Analytical balance

6.1 Principle

6.2 Working

6.3 Maintenance

Module III: Concept of pH

7. Concept of pH

7.1 Definition

7.2 Henderson Hassel batch equation

7.3 Pka value

7.4 pH indicator

7.5 Methods of measurement of pH

7.5.1 pH paper

7.5.2 pH meter

7.5.3 Principle, working, maintenance and calibration of pH meter

Module IV: Volumetric Analysis

8. Volumetric analysis

8.1 Normal and molar solutions

8.2 Standard solutions

8.3 Preparation of reagents

8.4 Storage of chemicals

9. Osmosis

9.1 Definition

9.2 Types of osmosis

9.3 Factors affecting osmotic pressure

9.4 Vant Hoff ‘s equation

9.5 Applications of osmosis

9.6 Dialysis

Suggested Readings

1. Text book of Medical Laboratory Technology by P. B. Godker

2. Medical Laboratory Technology by K.L. Mukherjee volume III

3. Practical Clinical Biochemistry by Harold Varley

4. Principal of Biochemistry by M. A. Siddiqi

5. Instrumental Analysis by Chatwal Anand

6. Text book of Medical Biochemistry by Chatterjee, Shinde

7. Principal of Biochemistry by Lehninger

8. Biochemistry by Voet&Voet

9. Biochemistry by Stryer.

COURSE TITLE: GENERAL CLINICAL MICROBIOLOGY - Lab

COURSE CODE: MLT41202

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objectives:

- ✓ This subject gives a general insight into the history and basics of medical microbiology, imparts knowledge about equipment used in Medical Microbiology and basic procedures done in a medical microbiology laboratory i.e., microscopy, sterilization, disinfection, culture methods required to perform different microbiological tests in clinical microbiology lab and biomedical waste management.

Course Content:

1. To demonstrate safe code of practice for a Microbiology laboratory

2. To prepare cleaning agents & to study the technique for cleaning & sterilization of glassware.

3. To demonstrate the working & handling of Compound microscope.

4. To demonstrate the method of sterilization by autoclave including its efficacy testing.

5. To demonstrate the method of sterilization by hot air oven including its efficacy testing.

6. To demonstrate the method of sterilization of media/solution by filtration.

7. Demonstration of Antiseptics, Spirit, Cetrimide& Povidone-Iodine.

8. To demonstrate the use of disinfectants.

9. Demonstrate the precaution while using disinfectants.

10. To prepare working dilution of commonly used disinfectants.

11. In-use test

12. Rideal-walker phenol co-efficient test.

13. Kelsey-Sykes test

14. To demonstrate the different morphological types of bacteria

15. Preparation of one culture media from each type

16. To demonstrate aerobic culture

17. To demonstrate anaerobic culture

18. Visit to animal house & demonstrate about care of laboratory animals

COURSE TITLE: BASIC HAEMATOLOGY – Lab

COURSE CODE: MLT41204

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objectives:

- ✓ This subject aware of the composition of blood and methods of estimating different components of blood. Students will learn the basic concepts of Haematology & routine clinical investigations of Haematology laboratory.

Course Content:

List of Experiments:

1. Preparation of various anticoagulants:

1.1 EDTA

1.2 Sodium Citrate,

1.3 Oxalate with Fluoride

2. Collection of blood sample for various Lab Investigations

3. Familiarization and working of routine Haematology Lab. Instruments

3.1 Microscopes

3.2 Haemocytometers

3.3 Colorimeter

3.4 Spectrophotometer

3.5 Glass pipettes & Auto pipettes

3.6 Glassware

3.7 Sahli‘s Apparatus

4. Identification of Normal blood cells

5. Urine Analysis:

5.1 Routine biochemistry of Urine for:

5.1.1 pH

5.1.2 Specific Gravity

5.1.3 Glucose

5.1.4 Ketones

5.1.5 Bilirubin

5.1.6 Albumin

5.2 Microscopic Examination of Urine

COURSE TITLE: HUMAN ANATOMY & PHYSIOLOGY – Lab

COURSE CODE: MLT41206

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ Students will learn the various cells and tissues of different systems of human body, understand the gross morphology, structure and functions of bones and various organs of the human body.

Course Content:

List of Experiments

1. Demonstration of various parts of body

2. Demonstration of tissues of body

3. Demonstration of parts of digestive system

4. Demonstration of parts of respiratory system

5. Demonstration of parts of skin

6. Demonstration of parts of excretory system

7. Demonstration of various parts of circulatory system (Demonstration from models)

8. Examination of blood film for various blood cells from stained slides

9. Blood pressure estimation

10. Demonstration of various parts of nervous system (brain and spinal cord) (Model)

11. Structure of eye and ear (demonstration from models)

12. Demonstration of reflex action

13. Demonstration of structural differences between skeletal, smooth and cardiac muscles (Permanent mounts)

14. Demonstration of various bones and joints

15. Demonstration of various parts of reproductive system (Male and female from models and charts)

16. To study circulatory system from charts and transverse section (TS) of artery and vein from permanent slides.

17. To study digestive system from charts and TS of liver, spleen and pancreas from permanent slides.

18. Study of Urinary system (charts)

19. Study of Genital system (male & female) from charts and TS of testis and ovary from permanent slides.

20. To study nervous system (From models / charts)

21. To study various body fluids.

Note: Demonstrations can be done with the help of models, charts and histological slides

COURSE TITLE: BASIC CLINICAL BIOCHEMISTRY – Lab

COURSE CODE: MLT41208

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ This subject introduces handling of glassware and solutions.

Course Content:

List of Experiments

1. Cleaning of the laboratory glass ware (Volumetric and non-volumetric)
2. Preparation of distilled water
3. Principle, working and maintenance of pH meter.
4. To prepare 0.1 N NaOH solution.
5. To prepare 0.2N HCl solution.
6. To prepare 0.1 molar H_2SO_4
7. To prepare 0.2 Molar Sodium carbonate solution.
8. Demonstration of osmosis and dialysis.

COURSE TITLE: GUEST LECTURE/TUTORIAL/SEMINAR/VISIT TO ANY MEDICAL RESEARCH INSTITUTION OR REPUTED CLINICAL

COURSE CODE: MLT41210

COURSE CREDIT: 2

CONTACT HOURS: 30

YEAR – II

SEMESTER – III

COURSE TITLE: SYSTEMATIC BACTERIOLOGY

COURSE CODE: MLT42101

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: This subject will give information about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

Course Objective:

- ✓ This subject will give information about the different types of bacterial culture procedures, staining procedures and biochemical tests used for identification of bacteria. The students will learn the morphology cultural characteristics, biochemical characteristics & laboratory diagnosis of various bacteria.

Course Outcomes:

- ➢ CO1: The course provides the conceptual basis for understanding pathogenic microorganisms and the mechanisms by which they cause disease in the human body.
- ➢ CO2: Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.
- ➢ CO3: Explain the methods of microorganism's control, e.g., antibiotic therapy & vaccines. Solve problems in the context of this understanding.

Course Content

Module I: Bacterial Culture

1. Bacterial culture

1.1 Instruments used to seed culture media

1.2 Culture procedures – seeding a plate

2. Staining techniques in bacteriology

2.1 Significance of staining in bacteriology

2.2 Principle, Reagent preparation, procedures and interpretation of the following

2.2.1 Simple staining

2.2.2 Negative staining

2.2.3 Gram stain

2.2.4 Albert 's stain

2.2.5 Neisser 's stain

2.2.6 Ziehl –Neelsen staining

2.2.7 Capsule staining

2.2.8 Flagella staining

2.2.9 Spore staining

2.2.10 Fontana stain for spirochetes

Module II: Principle, procedure to identify bacteria

3. Principle, procedures and interpretation of the following biochemical tests for identification of different bacteria.

3.1 Catalase

3.2 Coagulase

3.3 Indole

3.4 Methyl Red

3.5 VogesProskauer

3.6 Urease

3.7 Citrate

3.8 Oxidase

3.9 TSIA

3.10 Nitrate reduction

3.11 Carbohydrate fermentation

3.12 Huge and Leifson

3.13 Bile solubility

3.14 H 2 S production

3.15 Demonstration of motility

3.16 Decarboxylases

3.17 CAMP

3.18 Hippurate hydrolysis

3.19 Nagler‘s reaction

3.20 Cholera-red reaction

Module III: Definition, Classification, Various characteristics of the following bacteria

4. Definition, Classification, Various characteristics (morphological, cultural and biochemical), pathogenesis and laboratory diagnosis of the following bacteria

4.1 Staphylococcus

4.2 Streptococcus

4.3 Pneumococcus

4.4 Neisseria gonorrhea and Neisseria meningitis

4.5 Haemophilis

4.6 Corynebacterium

4.7 Enterobacteriaceae: Escherichia coli, Klebsiella, Citrobacter, Enterobacter, Proteus, Salmonella, Shigella, Yersinia enterocolitica and Yersinia pestis

4.8 Vibrio, Aeromones and Plesiomonas

4.9 Clostridia of wound infection

4.10 Mycobacterium tuberculosis complex, Atypical Mycobacteria and M. leprae

4.11 Spirochetes – Treponema, Borrellia and leptospira

4.12 Bordetella and brucella

4.13 Mycoplasma and Ureaplasma

4.14 Rickettsia

4.15 Chlamydia

4.16 Actinomyces

4.17 Pseudomonas and Burkholderia

4.18 Brief introduction about non sporing anaerobic cocci and bacilli

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2

2. Text book of Microbiology by Ananthanarayanan

3. Medical Microbiology by Paniker & Satish Gupte

4. Medical laboratory Technology Vol. I, II, III by Mukherjee

COURSE TITLE: BASICS OF HAEMATOLOGICAL DISEASES

COURSE CODE: MLT42103

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will be made aware of various diseases like anaemia, quantitative disorders of Leucocytes, morphological alterations in blood cells, bleeding disorders.

Course Objective:

- ✓ The students will be made aware of various diseases like anaemia, quantitative disorders of Leucocytes, morphological alterations in blood cells, bleeding disorders.

Course Outcomes:

- CO1: The students be made aware of Safety precautions, Quality assurance, biomedical waste management and automation in haematology. It will also cover red cell abnormalities, Disorder of leukocytes, Investigations of a case suffering from bleeding disorders, to learn about tests carried out for haematological investigations.
- CO2: Understanding of Haemopoietic disorders, laboratory diagnosis of leukaemia, haemolytic anaemia.
- CO3: Collection & preservation of blood for the investigations.

Course Content:

Module I: Anaemia

1. Anaemia

1.1 Introduction

1.2 Classification

1.2.1 Microcytic hypochromic anaemia

1.2.2 Macrocytic anaemia

1.2.3 Normocytic normochromic anaemia

Module II: Quantitative disorders of Leukocytes Cause and significance

2. Quantitative disorders of Leukocytes Cause and significance

2.1 Granulocytic and Monocytic Disorders

2.2 Lymphocytic Disorders

3. Morphologic Alterations in Neutrophils

3.1 Toxic granulation

3.2 Cytoplasmic vacuoles

3.3 Döhle bodies

3.4 May–Hegglin anomaly

3.5 Alder–Reilly anomaly

3.6 Pelger–Huët anomaly

3.7 Chédiak–Higashi syndrome

Module III: Disorders of Bleeding

4. Bleeding disorders

4.1 Introduction Causes of bleeding disorders

4.2 Vascular defect

4.2.1 Platelet defect

4.2.2 Factor deficiency

4.2.3 Inhibitors

4.2.4 Hyper fibrinolysis

4.3 Types of bleeding disorders

4.3.1 Inherited bleeding disorders

4.3.2 Acquired bleeding disorders

Module IV: Thrombosis

5. Thrombosis

5.1 Introduction

5.2 Causes of thrombosis

6. Monitoring of Anticoagulants

6.1 Oral anticoagulants by INR

6.2 Heparin

Suggested Readings

1. Textbook of Medical Laboratory Technology by Praful B. Godkar

2. Medical Laboratory Technology by K L Mukherjee Volume-I

3. Practical Haematology by J.B. Dacie

4. Clinical Diagnosis & Management by Laboratory methods (20thedition) by John Bernard Henry

5. Atlas of Haematology by G.A. McDonald

6. De Gruchy's clinical Haematology in medical practice

7. Wintrobe's Clinical Haematology– 2013 by John P. Greer, Daniel A. Arber, Bertil E. Glader, Alan F. Lis

COURSE TITLE: BIOCHEMICAL METABOLISM

COURSE CODE: MLT42105

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: This subject shall give information about all the major metabolic pathways occurring in our body. The students will learn the details about metabolism of carbohydrates, proteins, lipids, nucleic acids, enzymes & the deficiency diseases related to them.

Course Objective:

- ✓ This subject shall give information about all the major metabolic pathways occurring in our body. The students will learn the details about metabolism of carbohydrates,

proteins, lipids, nucleic acids, enzymes & the deficiency diseases related to them.

Course Outcomes:

- CO1: Student will able to integrate the basic biological and chemical knowledge and its structure to develop a foundation in the concepts and facts in modern cell and molecular biology and biochemistry, and to be familiar with various ways of organizing and accessing scientific knowledge.
- CO2: Students will acquire the concept of anabolism, catabolism and role of high energy compounds in the cell. They will acquire knowledge related to regulation of various pathways. The fact that perturbations in the carbon metabolism can lead to various disorders such as diabetes and cancer will be explained. The student will appreciate the fact that differences in the properties of metabolic enzymes of the host and pathogens can be exploited for the development of new drugs. Finally, the student will gain insights into metabolic engineering for the production of useful biomolecules.

Course Content

Module I: Introduction to Carbohydrate Metabolism

1. Carbohydrate Metabolism

1.1 Introduction, Importance and Classification

1.2 Digestion and Absorption

1.3 Metabolism: - Glycolysis, Citric acid cycle, Gluconeogenesis, Glycogenolysis,

Glycogenesis

1.4 Disorders of carbohydrate metabolism.

Module II: Introduction to Protein Metabolism

2. Protein Metabolism

2.1 Introduction, Importance and classification

2.2 Important properties of proteins

2.3 Digestion & absorption of Proteins

2.4 Protein synthesis

2.5 Metabolism of proteins

2.6 Disorders of protein metabolism and Urea Cycle

Module III: Introduction to Lipid Metabolism

3. Lipid

3.1 Introduction & Classification

3.2 Digestion & absorption of fats

3.3 Lipoproteins

3.4 Fatty acid biosynthesis & fatty acid oxidation

Module IV: introduction to Nucleic Acid Metabolism

4. Nucleic Acid

4.1 Introduction

4.2 Functions of Nucleic acid

4.3 Functions of energy carriers

Module V: Enzymes

5. Enzymes

5.1 Introductions, Importance & Classifications

5.2 Properties of enzymes

5.3 Mechanism of enzyme action

5.4 Factors affecting enzyme action

5.5 Enzyme kinetics & enzyme inhibiters

Suggested Readings

1. Practical Clinical Biochemistry by Harold Varley

2. Text book of Medical Laboratory Technology by P. B. Godker

3. Medical Laboratory Technology by Mukherjee

4. Principal of Biochemistry by M. A. Siddiqi

5. Instrumental Analysis by Chatwal Anand

6. Text book of Medical Biochemistry by Chaterjee, Shinde

7. Principal of Biochemistry by Lehninger

8. Biochemistry by Voet&Voet

9. Biochemistry by Stryer

COURSE TITLE: FUNDAMENTALS OF HISTOLOGY

COURSE CODE: MLT42107

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The student will study diseases associated with different body organs and systems.

Course Objective:

- ✓ The student will study diseases associated with different body organs and systems.

Course Outcomes:

- ➢ CO1: be able to identify and describe in detail the microscopic structure of the major organs, tissues and cells of the body

- CO2: be able to explain the theoretical background to surgical cutup, tissue fixation, tissue processing, microtomy and staining using routine and specialised techniques
- CO3: be able to demonstrate proficiency in the preparation of routine formalin-fixed, paraffin-embedded tissue sections
- CO4: be able to demonstrate proficiency in haematoxylin and eosin staining, selected special stains and immunohistochemical methods

Course Content

Module I: Introduction to Histology

1. Alimentary System: Diseases of mouth, Diseases of Esophagus- Esophageal varices.

2. Digestive System: Gastritis, Peptic ulceration, Appendicitis microbial diseases, food poisoning, hernia, Intestinal obstructions & mal absorption.

Module II: Disease related to GI, Circulatory and Respiratory system

3. Accessory Digestive glands: Salivary glands- mumps

3.1 Liver – hepatitis, liver failure, cirrhosis.

3.2 Pancreas- pancreatitis.

3.3 Gall Bladder- Gall stones, jaundice and cardiovascular diseases.

4. Circulatory System: Diseases of Blood vessels- Atheroma, Arteriosclerosis, heart block. Disorders of Blood Pressure-Hyper & Hypotension.

5. Respiratory System: Upper respiratory tract infection, Bronchi, Asthma, Pneumonia, Lung abscess, Tuberculosis, Lung Collapse.

Module III: Disease related to Urinary system, Nervous system and Endocrine system

6. Urinary System: Glomerulonephritis, Nephrotic syndrome, renal failure, renal calculi, Urinary obstruction, Urinary tract infection.

7. Reproductive system: Sexually transmitted diseases, Pelvic inflammatory disease, disorder of cervix (CIN), Disease of ovaries, ectopic pregnancy, prostatitis, Infertility

8. Nervous System: Neuronal damage, ICP, Cerebral Infarction, head injury, Alzheimer ‘s disease, dementia.

9. Endocrine System:

9.1 Pituitary: Hyper & Hypo secretions

9.2 Thyroid: Goiter

9.3 Adrenal: Cushing Syndrome, Addison Disease

9.4 Pancreas: Diabetes

10. Sense Organs:

10.1 Ear: Otitis

10.2 Eye: Cataract

Suggested readings

1. Anatomy &Physiology – Ross and Wilson

2. Human Anatomy and Physiology by Pearce

3. Di Fiore ‘s Atlas of Histology

4. Medical Laboratory Technology by KL Mukherjee-Volume III

5. Text book of Pathology by Robbins

COURSE TITLE: SYSTEMATIC BACTERIOLOGY – Lab

COURSE CODE: MLT42201

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will study diseases associated with different body organs and systems.

Course Content

1. To demonstrate the instruments used to seed culture media

2. To learn techniques for Inoculation of bacteria on culture media

3. To isolate specific bacteria from a mixture of organisms.

4. To demonstrate simple staining (Methylene blue)

5. To prepare India ink preparation to demonstrate negative staining.

6. Bacterial identification: To demonstrate reagent preparation, procedure and interpretation for

6.1 Gram stain

6.2 Albert stain

6.3 Neisser ‘s staining

6.4 Z-N staining

6.5 Capsule staining

6.6 Demonstration of flagella by staining methods

6.7 Spore staining

6.8 To demonstrate spirochetes by Fontana staining procedure

7. To prepare the reagent and demonstrate following biochemical tests with positive and negative control bacteria:

7.1 Catalase

7.2 Coagulase

7.3 Indole

7.4 Methyl Red (MR)

7.5 Voges Proskauer (VP)

7.6 Urease

7.7 Citrate

7.8 Oxidase

7.9 TSIA

7.10 Nitrate reduction

7.11 Carbohydrate fermentation

7.12 Huge and Leifson

7.13 Bile solubility

7.14 H2S production

7.15 Demonstration and motility

7.16 Decarboxylases

7.17 CAMP

7.18 Hippurate hydrolysis

7.19 Nagler‘s reaction

8. To demonstrate various characteristics (morphological, cultural and biochemical) of bacteria commonly isolated from clinical samples i.e.

8.1 Staphylococcus

8.2 Streptococcus

8.3 Corynebacterium

8.4 Escherichia coli

8.5 Klebsiella

8.6 Citrobacter

8.7 Enterobacter

8.8 Proteus

8.9 Salmonella

8.10 Shigella

8.11 Vibrio cholera

8.12 Mycobacterium tuberculosis

8.13 Pseudomonas

COURSE TITLE: BASICS OF HAEMATOLOGICAL DISEASES – Lab

COURSE CODE: MLT42203

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will study diseases associated with blood and its composition.

Course Content:

1. Parts of microscope; its functioning and care
2. Parts of centrifuge; its functioning and care
3. Cleaning and drying of glassware
4. Preparation of various anticoagulants
5. Collection of venous and capillary blood
6. Cleaning of glass-syringes and its sterilization
7. Preparation of the stains and other reagents
8. Preparation of peripheral blood film (PBF)
9. Staining of PBF
10. Haemoglobin estimation methods (Sahli‘s, Oxyhaemoglobin, and cyanmethaemoglobin)
11. Differential leukocyte count (DLC)
12. Recognition and staining of various types of blood cells (normal and abnormal)
13. Preparation of thick and thin blood smear for malarial parasite (Leishman/Giemsa/JSB)
14. RBC counting
15. WBC counting
16. Platelet counting
17. Routine Examination of urine

COURSE TITLE: BIOCHEMICAL METABOLISM – Lab

COURSE CODE: MLT42205

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will study the basic biochemistry how to identify carbohydrate, fat and protein through biochemical tests.

Course Content

1. To determine the presence of carbohydrates by Molisch test.
2. To determine the presence of reducing sugar by Fehling solutions
3. To determine the presence of reducing sugar by Benedicts method.
4. To determine starch by Iodine test.
5. Determination of Glucose in serum & plasma
6. Estimates of blood Glucose by Folin& Wu method
7. Determination of Urea in serum, plasma & urine.
8. Determination of Creatinine in serum or plasma
9. Determination of serum Albumin
10. Determination of Cholesterol in serum or plasma

COURSE TITLE: FUNDAMENTALS OF HISTOLOGY – Lab

COURSE CODE: MLT42207

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will study the fundamentals of histology i.e., preparation and identification of different type of tissues.

Course Content:

1. To study squamous cell from cheek cells (Buccal mucosa)
2. To study stained slide preparation from organs of digestive system
3. Study of stained slides of liver, pancreas, gall bladder
4. Study of various types of microscopes and draw diagram in practical notebook
5. To study stained slide preparation from organs of circulatory system

6. To study stained slide preparation from organs of Respiratory system

7. To study stained slide preparation from organs of Nervous system

8. To study stained slide preparation from organs of Urinary system

9. To study stained slide preparation from organs of Endocrine system

COURSE TITLE: GUEST LECTURE/TUTORIAL/SEMINAR/VISIT TO ANY MEDICAL RESEARCH INSTITUTION OR REPUTED CLINICAL

COURSE CODE: MLT42209

COURSE CREDIT: 2

CONTACT HOURS: 30

YEAR – II

SEMESTER – IV

COURSE TITLE: APPLIED BACTERIOLOGY

COURSE CODE: MLT42102

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: This part will cover 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. This will also cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections. Further it will make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.

Course Objective:

- ✓ This part will cover 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. This will also cover bacteriological examination of water, milk, food, air, I/V fluids and nosocomial infections. Further it will make the candidate familiar to epidemiology, epidemiological markers and preservation of microbes.

Course Outcomes:

- ➢ CO1: The student would be able to acquire knowledge of bacterial growth and its mechanism.
- ➢ CO2: Student will be able to tell the distinguishing features of prokaryotes and eukaryotes.
- ➢ CO3: Students would have knowledge of different sterilization techniques and microbial identification techniques.

Course Content

Module I: Diagnosis of different disorders

1. 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:

1.1 Septicemia and bacteremia

1.2 Upper Respiratory tract infections

1.3 Lower respiratory tract infections

1.4 Wound, skin, and deep sepsis

1.5 Urinary tract infections

1.6 Genital Tract infections

1.7 Meningitis

1.8 Gastro intestinal infections

1.9 Enteric fever

1.10 Tuberculosis (Pulmonary and Extra-pulmonary)

1.11 Pyrexia of unknown origin

Module II: Antibiotics

2. Antibiotic susceptibility testing in bacteriology

2.1 Definition of antibiotics

2.2 Culture medium used for Antibiotic susceptibility testing

2.3 Preparation and standardization of inoculum

2.4 Control bacterial strains

2.5 Choice of antibiotics

2.6 MIC and MBC: Concepts and methods for determination

2.7 Various methods of Antibiotic susceptibility testing with special reference to Stokes and Kirby-Bauer method

3. Basics of Nucleic acid techniques in diagnostic microbiology with special reference to Polymerase chain reaction (PCR)

4. Automation in bacterial culture detection and antimicrobial susceptibility testing: Principles and importance.

Module III: Bacteriological examination of water, milk, food and air

5. Bacteriological examination of water, milk, food and air

5.1 Examination of water

5.1.1 Collection and transportation of water sample

5.1.2 Presumptive coliform count

5.1.3 Eijkman test

5.1.4 Introduction and importance of other bacteria considered as indicators of fecal contamination

5.1.5 Membrane filtration tests

5.1.6 Interpretation of results

5.2 Examination of Milk and milk products

5.2.1 Basic Concepts regarding gradation of milk

5.2.2 Various tests for Bacteriological examination of milk

5.3 Examination of food articles

5.3.1 Basic Concepts regarding classification of food like frozen food, canned food, raw food, cooked food etc.

5.3.2 Various tests for Bacteriological examination with special reference to food poisoning bacteria

5.4 Examination of Air

5.4.1 Significance of air bacteriology in healthcare facilities

5.4.2 Settle plate method

5.4.3 Types of air sampling instruments

5.4.4 Collection processing and reporting of an air sample

Module IV: Sterility testing of I/v fluids

6. Sterility testing of I/v fluids

6.1 Collection, transportation and processing of I/v fluids for bacterial contamination

6.2 Recording the result and interpretation

7. Nosocomial Infection:

7.1 Introduction, sources and types of nosocomial infections.

7.2 Surveillance of hospital environment for microbial load.

7.3 Role of microbiology laboratory in control of nosocomial infections

Module V: Epidemiological Markers

8. Epidemiological markers:

8.1 Introduction

8.2 Types

8.3 Serotyping

8.4 Phage typing and

8.5 Bacteriocin typing

9. Preservation methods for microbes

9.1 Basic concepts of preservation of microbes

9.2 Why do we need to preserve bacteria?

9.3 Principle and procedures of various short term and long-term preservation methods

with special reference to Lyophilization

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2

2. Text book of Microbiology by Ananthanarayanan

3. Medical Microbiology by Paniker& Satish Gupte

4. Medical laboratory Technology Vol. I ,II, III by Mukherjee

5. Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough

6. Hospital Acquired Infections-Power strategies for clinical practice by Dr. V Muralidhar and Sumathi Murlidhar

7. Control of Hospital infection-A practical Handbook by Gaj Ayliffe, A.P. Fraise, A.M. Geddes, K. Mitchell

COURSE TITLE: APPLIED HAEMATOLOGY - I

COURSE CODE: MLT42104

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will be made aware of the methods of estimating different components of blood. Students will learn the basic concepts of staining and coagulation in Haematology laboratory.

Course Objective:

- ✓ The students will be made aware of the methods of estimating different components of blood. Students will learn the basic concepts of staining and coagulation in Haematology laboratory.

Course Outcomes:

- CO1: Differentiate various laboratory test findings with their associated clinical conditions.
- CO2: Identify the various skills necessary to perform blood counts, evaluate blood elements, and report results within the stated limits of accuracy.
- CO3: Describe the various components of blood, their functions, and roles in various disease states.
- CO4: To be able to demonstrate good skills in the relevant Hematology laboratory methodology.
- CO5: Collection of blood for the investigations.
- CO6: Be able to distinguish the developmental stages of blood cells.
- CO7: To be able to carry out blood sampling.

Module I: RBC and Haemoglobin

1. Haemoglobinometry: Different methods to measure Haemoglobin with merits and demerits

2. Haemocytometery: Introduction, Principle, Reagent preparation, procedure, errors involved and means to minimize errors.

2.1 RBC Count,

2.2 Total leucocytes count (TLC)

2.3 Platelet Count.

2.4 Absolute Eosinophil count

3. Principle mechanism and different methods with merit and demerits for the measuring

Erythrocyte Sedimentation Rate (ESR) and its significance

4. Different methods with merit and demerits for packed cell volume/Haematocritvalue

Module II: Blood film and staining

5. Preparation of blood films

5.1 Types, Methods of preparation (Thick and thin smear/film) and utility

6. Staining techniques in Haematology (Romanowsky ‘s stains): Principle, composition, preparation of staining reagents and procedure of the following

6.1 Giemsa ‘s stain

6.2 Leishman ‘s stain

6.3 Wright ‘s stain

6.4 Field ‘s stain

6.5 JSB stain.

Module III: Red cell indices and Counting

7. Differential leucocytes count (DLC)

8. Normal and absolute values in Haematology

9. Physiological variations in Hb, PCV, TLC and Platelets

10. Macroscopic and microscopic examination of seminal fluid

11. Examination of CSF and other body fluids for cytology i.e. pleural, peritoneal and synovial fluid etc.

12. Preparation of Reagents for coagulation studies:

12.1 M/40 Calcium chloride

12.2 Brain Thromboplastin

12.3 Cephalin

12.4 Adsorbed Plasma

13. Screening Tests for coagulation Studies and their significance

Suggested Readings:

1. Textbook of Medical Laboratory Technology by Praful B. Godkar
2. Medical laboratory Technology by K. L. Mukherjee Volume-I
3. Practical Haematology by J.B. Dacie
4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henry
5. Atlas of Haematology by G. A. McDonald
6. De Gruchy's Clinical Haematology in medical practice.

COURSE TITLE: ANALYTICAL CLINICAL BIOCHEMISTRY

COURSE CODE: MLT42106

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale

The students will learn basic principles/mechanisms, procedures and various types of techniques commonly performed in analytical biochemistry such as:

Course Objective:

- ✓ The students will learn basic principles/mechanisms, procedures and various types of techniques commonly performed in analytical biochemistry such as:

Course Outcomes:

- CO1: The student would be able to conduct routine clinical biochemical tests.
- CO2: Students would be able to perform specialised Biochemical tests.
- CO3: Students would be able to estimate quantitatively basic and routine investigations.

Course Content:

Module I: Spectrophotometry and Colorimetry

1. Spectrophotometry and colorimetry

1.1 Introduction

1.2 Theory of spectrophotometry and colorimetry

1.3 Lambert`s law and Beer`s law

1.4 Applications of colorimetry and spectrophotometry

Module II: Photometry

2. Photometry

2.1 Introduction

2.2 General principles of flame photometry

2.3 Limitations of flame photometry

2.4 Instrumentation

2.5 Applications of flame photometry

2.6 Atomic absorption spectroscopy – Principle & applications

Module III: Chromatography

3. Chromatography

3.1 Introduction

3.2 Types of chromatography

3.3 Paper Chromatography: Introduction, principle, types, details for qualitative and quantitative analysis, application

3.4 Thin layer chromatography: Introduction, experimental techniques, application of TLC, limitations, High performance thin layer chromatography

3.5 Column chromatography: Introduction, principle column efficiency, application of column chromatography

3.6 Gas chromatography: Introduction principle, instrumentation, application

3.7 Ion exchange chromatography: Introduction, Definition and principle, cation and anion exchangers, application

3.8 Gel Chromatography: Introduction Principle and method, application and advantages

Module IV: Electrophoresis

4. Electrophoresis:

4.1 Introduction

4.2 Principle

4.2.1 Instrumentation

4.2.2 Applications

4.3 Types of electrophoresis

4.3.1 Paper electrophoresis

4.3.2 Gel electrophoresis

Suggested readings

1. Practical Clinical Biochemistry by Harold Varley

2. Text book of Medical Laboratory Technology by P. B. Godker

3. Medical Laboratory Technology by Mukherjee

4. Principal of Biochemistry by M. A. Siddiqi

5. Instrumental Analysis by Chatwal Anand

6. Text book of Medical Biochemistry by Chatterjee, Shinde

7. Principal of Biochemistry by Lehninger

8. Biochemistry by Voet &Voet

9. Biochemistry by Stryer

COURSE TITLE: APPLIED HISTOPATHOLOGY – I

COURSE CODE: MLT42108

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: In this section, students will be made aware of terminology used in histotechnology, various instruments and their maintenance and also learn the processing of various samples for histopathological investigations.

Course Objective:

- ✓ In this section students will be made aware of terminology used in histotechnology, various instruments and their maintenance and learn the processing of various samples for histopathological investigations.

Course Outcomes:

- CO1: Demonstrate proficiency and expertise in the proper use of the light microscope in examining histological specimens on glass slides.
- CO2. Understand the basic concepts of tissue fixation, dehydration, embedding, sectioning, staining and mounting of slides for histological examination, immunofluorescent staining and electron microscopy.
- CO3. Recognize, identify and describe the characteristic structures of cells, tissues and organ systems of the body at the light microscope histologic level, and for selected tissues, at the electron microscopic ultrastructural level.
- CO4. Know and understand the characteristics of tissues of the body (epithelium, connective, muscle, nerve) and their relationships in the various organ systems of the human body.
- CO5. Understand the basic functions of cells and cellular organelles, tissues and organ systems of the body as correlated with their histological structures.

Course Content

Module I:

1. Introduction to Histotechnology

Module II: Compound microscope:

2.1 Optical system, magnification and maintenance

2.2 Microscopy:

2.2.1 Working principle

2.2.2 Applications of various types of microscopes i.e. dark field, polarizing, phase contrast, interference and fluorescent microscope

Module III: Care and maintenance of laboratory equipment used in histotechnology

Module IV: Safety measures in a histopathology laboratory

Module V: Basic concepts about routine methods of examination of tissues

Module VI: Collection and transportation of specimens for histological examination

Module VII: Basic concepts of fixation

Module VIII: Various types of fixatives used in a routine histopathology laboratory

8.1 Simple fixatives

8.2 Compound fixatives

8.3 Special fixatives for demonstration of various tissue elements

Module IX: Decalcification

9.1 Criteria of a good decalcification agent

9.2 Technique of decalcification followed with selection of tissue, fixation,

And decalcification, neutralization of acid and thorough washing

9.3 Various types of decalcifying fluids: Organic & Inorganic Acid, chelating agents, Use of Ion-exchange resigns and Electrophoretic decalcification and treatment of hard tissues which are not calcified

Module X: Processing of various tissues for histological examination

10.1 Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing.

10.2 Components & principles of various types of automatic tissue

Suggested readings: 1. Text book of Preventive Medicine by Par and Park for infection prevention and control 2. Text book of Microbiology by Ananthanaryanan for Antibiotic Resistance

COURSE TITLE: APPLIED BACTERIOLOGY- - LAB

COURSE CODE: MLT42204

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objectives:

- ✓ The student will study the clinical bacteria and their identification.

Course Content
List of Experiments:

1. Inoculation of different culture media

1.1 Isolation of pure cultures

2. Processing of following clinical samples for culture and identification of bacterial pathogens:

3.1 Blood 3.2 Throat swab 3.3 Sputum 3.4 Pus 3.5 Urine 3.6 Stool for Salmonella, Shigella and Vibrio cholerae 3.7 C.S.F. and other body fluids

4. Demonstration of PCR

5. Demonstration of automation in bacterial culture detection and antimicrobial susceptibility testing

6. Antimicrobial susceptibility testing 6.1 Introduction and terms used

6.2 Preparation and standardization of inoculum 6.3 To demonstrate reference bacterial strains 6.4 To determine MIC and MBC of known bacteria against a known antibiotic 6.5 To perform antibiotic susceptibility testing of clinical isolates by using 6.5.1 Stokes method 6.5.2 Kirby-Bauer method

7. Collection, transportation and processing of following articles for bacteriological examination: 7.1 Water 7.2 Milk 7.3 Food and 7.4 Air

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

9. Demonstration of serotyping and bacteriocin typing

10. Demonstration of lyophilization and other available preservation methods

COURSE TITLE: APPLIED HAEMATOLOGY - I - LAB

COURSE CODE: MLT42204

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will study the Hematological disorders and their diagnostic techniques.

Course Content

List of Experiments:

1. Hb Estimation

1.1 Sahli‘s method

1.2 Cyanmetha haemoglobin method

1.3 Oxyhaemoglobin method

2. Total leukocyte count

3. Platelets count

4. Absolute Eosinophil count

5. Preparation of smear and staining with Giemsa and Leishmanstain.

6. ESR(Wintrobe and Westergren method)

7. Packed cell volume (Macro&Micro)

8. Cytological examination of CSF and other body fluids

9. Physical and Microscopic examination of seminal fluid including sperm count

10. Perform normal DLC

11. Preparation of M/40 Calcium chloride

11.1 Brain thromboplastin and standardization

11.2 Cephalin

11.3 Adsorbed plasma

12. Perform BT, CT, Hess test, PT and APTT

COURSE TITLE: ANALYTICAL CLINICAL BIOCHEMISTRY - LAB

COURSE CODE: MLT42206

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will study the routine biochemical techniques and chemical pathology.

Course content

List of Experiments:

1. To demonstrate the principle, working & maintenance of spectrophotometer.

2. To demonstrate the principle, working & maintenance of colorimeter.

3. To demonstrate the principle, working & maintenance of flame photometer.

4. To demonstrate the principle, procedure of paper chromatography.

5. To demonstrate the principle & procedure of Gas chromatography.

6. To demonstrate the principle & demonstration of TLC.

7. To demonstrate the principle & procedure of column chromatography.

8. To demonstrate the principle & procedure of Electrophoresis.

COURSE TITLE: APPLIED HISTOPATHOLOGY - I - LAB

COURSE CODE: MLT42208

COURSE CREDIT: 2

CONTACT HOURS: 30

Course objective:

- ✓ The students will study the techniques to prepare slides using tissues and the body fluid that is used to diagnose various diseases.

Course Content

List of Experiments:

1. Demonstration of instruments used for dissection

2. Use of antiseptics, disinfectants and insecticides in a tissue culture processing laboratory

3. Reception and labeling of histological specimens

4. Preparation of various fixatives

4.1 Helly‘s fluid

4.2 Zenker‘s fluid

4.3 Bouin‘s fluid

4.4 Corney‘s fluid

4.5 10% Neutral formalin

4.6 Formal saline

4.7 Formal acetic acid

4.8 Pereyn‘s fluid

5. Testing of melting point of paraffin wax and perform embedding of given tissue in paraffin block

6. To process a bone for decalcification

7. To prepare ascending and descending grades of alcohol from absolute alcohol

8. Processing of tissue by manual and automated processor method

9. To demonstrate various part and types of microtome

10. To learn sharpening of microtome knife (Honing and stropping technique), and types of disposable blades in use (High and Low Profile).

11. To perform section cutting (Rough and Fine)

12. To practice attachment of tissue sections to glass slides

13. To learn using tissue floatation bath and drying of sections in oven (60-65C)

14. To perform & practice the Haematoxylin and Eosin staining technique

15. To perform & practice the Mallory ‘s Phospho tungstic Acid Haematoxylin (PTAH)

16. To learn mounting of stained smears

COURSE TITLE: GUEST LECTURE/TUTORIAL/SEMINAR/VISIT TO ANY MEDICAL RESEARCH INSTITUTION OR REPUTED CLINICAL

COURSE CODE: MLT42210

COURSE CREDIT: 2

CONTACT HOURS: 30

YEAR – III

SEMESTER – V

COURSE TITLE: IMMUNOLOGY AND BACTERIAL SEROLOGY

COURSE CODE: MLT43101

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.

Course Objective:

- ✓ This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.

Course Outcomes:

- CO1: Apply principles of safety, quality assurance and quality control in Immunology/Serology.
- CO2: Evaluate specimen acceptability.
- CO3: Describe the principals involved in the immune response.
- CO4: Identify the structure, function, and characteristics of immunoglobulins.
- CO5: Explain the principles of serological tests.
- CO6: Evaluate and correlate test results with associated diseases or conditions.

Course Content

Module I: Basic concept of Immunity

1. History and introduction to immunology

2. Immunity

2.1 Innate

2.2 Acquired immunity

2.3 Basic concepts about their mechanisms

3. Definition, types of antigens and determinants of antigenicity

Module II: Antigen-antibody reaction and different tests in Medical Microbiology

4. Definition, types, structure and properties of immunoglobulin

5. Antigen-Antibody reactions

5.1 Definition

5.2 Classification

5.3 General features and mechanisms

5.4 Applications of various antigen antibody reactions

6. Principle, procedure and applications of under mentioned in Medical Microbiology:

6.1 Complement fixation test

6.2 Immuno- fluorescence

6.3 ELISA

6.4 SDS-PAGE

6.5 Western blotting

Module III: Complement system and immune response

7. Principle, procedure and interpretation of various serological tests:

7.1 Widal

7.2 VDRL

7.3 ASO

7.4 CRP

7.5 Brucella tube agglutination

7.6 Rose-Waaler

8. Complement system:

8.1 Definition

8.2 Basic concepts about its components

8.3 Complement activation pathways

9. Immune response:

9.1 Introduction

9.2 Basic concepts of Humoral and Cellular immune responses

Module IV: Automation in serology and Vaccines

10. Hypersensitivity:

10.1 Definition

10.2 Types of hypersensitivity reactions

11. Basic concepts of autoimmunity and brief knowledge about autoimmune diseases

12. Automation in diagnostic serology

13. Vaccines:

13.1 Definition

13.2 Types

13.3 Vaccination schedule

13.4 Brief knowledge about 'Extended programme of immunization'(EPI) in India

Suggested Readings:

1. Practical Medical Microbiology by Mackie & McCartney Volume 1 and 2

2. Text book of Microbiology by Ananthanarayanan

3. Medical Microbiology by Paniker& Satish Gupte

4. Medical laboratory Technology Vol. I , II, III by Mukherjee

5. Medical Laboratory manual for tropical countries Vol II Microbiology by Monica Cheesbrough

6. Immunology by Riot

7. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites

COURSE TITLE: APPLIED HAEMATOLOGY- II

COURSE CODE: MLT43103

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will be made aware of the safety precautions in Haematology, basic concepts of Automation, quantitative assay of coagulation factors, karyotyping etc. and will learn about concepts such as safety precautions, quality assurance, biomedical waste management and automation in haematology. It will also cover bone marrow examination, red cell anomalies, disorder of leucocytes, L.E. cell phenomenon.

Course Objective:

- ✓ The students will be made aware of the safety precautions in Haematology, basic concepts of Automation, quantitative assay of coagulation factors, karyotyping etc. and will learn about concepts such as safety precautions, quality assurance, biomedical waste management and automation in haematology. It will also cover bone marrow examination, red cell anomalies, disorder of leucocytes, L.E. cell phenomenon.

Course Outcomes:

- CO1: Correlate haematological findings with those generated in other areas of the clinical laboratory, patient symptoms and clinical history, to make appropriate and effective on-the-job professional decisions.
- CO2: Perform basic haematological laboratory testing, assess laboratory data and report findings according to laboratory protocol.
- CO3: Adapt haematology laboratory techniques and procedures when errors and discrepancies in results are obtained to effect resolution in a professional and timely manner.

Course Content

Module I: Basics in haematology

1. Safety precautions in Haematology

2. Basic concepts of automation in Haematology with special reference to:

2.1 Blood cell counter

2.2 Coagulometer

3. Bone marrow examination

3.1 Composition and functions

3.2 Aspiration of bone marrow (Adults and children)

3.3 Processing of aspirated bone marrow (Preparation & staining of smear)

3.4 Brief knowledge about examination of aspirated bone marrow (differential cell counts and cellular ratios)

3.5 Processing and staining of trephine biopsy specimens

Module II: Red cell & LE cell

4. Red cell anomalies

4.1 Morphological changes such as variation in size shape & staining character.

5. Reticulocytes: Definition, different methods to count, Absolute reticulocyte count and IRF (Immature reticulocyte fraction) and significance of reticulocytes.

6. Lupus Erythematosus (L.E) cell phenomenon.

6.1 Definition of L.E. cell.

6.2 Demonstration of L.E. cell by various methods.

6.3 Clinical significance.

Module III: Coagulation factors

7. Correction studies for Factor deficiency

8. Quantitative assay of coagulation factors

8.1 Principle

8.2 Procedure

9. Screening of inhibitors

9.1 Inhibitors against coagulation factors

9.2 APLA

Module IV: Different disorders associated with haematology and their chromosomal studies

10. Karyotyping: Chromosomal studies in hematological disorders (PBLC and Bone marrow)

11. Cyto-chemical staining: Principles, method and significance

12. Biomedical waste management in Haematology laboratory (Other than Radioactive material)

Suggested Readings:

1. Text book of Medical Laboratory Technology by Paraful B. Godkar

2. Medical laboratory Technology by KL Mukherjee Volume-I

3. Practical Haematology by JB Dacie

4. Clinical Diagnosis & Management by Laboratory methods (20th edition) by John Bernard Henary

5. Atlas of Haematology (5th edition) by G.A. McDonald

6. De Gruchy's clinical Haematology in medical practice

COURSE TITLE: APPLIED CLINICAL BIOCHEMISTRY – I

COURSE CODE: MLT43105

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will be taught about Hazards & safety measures in a clinical biochemistry lab, Quality control and quality assurance, Laboratory organization, management Principles of assay procedures and Radioactivity.

Course Objective:

- ✓ The students will be taught about Hazards & safety measures in a clinical biochemistry lab, Quality control and quality assurance, Laboratory organization, management Principles of assay procedures and Radioactivity.

Course Outcomes:

- ➢ CO1: An ability to acquire in-depth theoretical and practical knowledge of Biochemistry and the ability to apply the acquired knowledge to provide cost efficient solutions in Biochemistry.
- ➢ CO2: An ability to properly understand the technical aspects of existing technologies that help in addressing the biological and medical challenges faced by humankind.
- ➢ CO3: An ability to translate knowledge of Biochemistry to address environmental, intellectual, societal and ethical issues through case studies presented in the class.

Module I: Basics in clinical biochemistry lab & different assay procedures

1. Hazards & safety measures in clinical Biochemistry laboratory

2. Quality control and quality assurance in a clinical biochemistry laboratory

3. Laboratory organization, management and maintenance of records

4. Principles of assay procedures, Normal range in blood, Serum, Plasma and Urine and reference values for:

4.1 Glucose

4.2 Proteins

4.3 Urea

4.4 Uric acid

4.5 Creatinine

4.6 Bilirubin

4.7 Lipids

Module II: Different errors and their corrections & Radioactivity and radioisotopes

5. Principles, procedures for estimation & assessment of the following including errors involved and their corrections

5.1 Sodium, Potassium and Chloride, Iodine

5.2 Calcium, Phosphorous and Phosphates

6. Instruments for detection of Radioactivity

7. Applications of Radioisotopes in clinical biochemistry.

8. Enzyme linked immune sorbent assay.

Suggested Readings:

1. Text book of Medical Laboratory Technology by P.B. Godkar.

2. Medical Laboratory Science, Theory & Practical by A. Kolhatkar.

3. Practical Clinical Biochemistry by Harold Varley.

4. Biochemistry, U. Satyanarayan& U. Chakrapani.

5. Text book of Medical Biochemistry by Chatterjee&Shinde.

6. Principal of Biochemistry by Lehninger

7. Biochemistry by Voet&Voet

8. Biochemistry by Stryer

COURSE TITLE: APPLIED HISTOPATHOLOGY – II

COURSE CODE: MLT43107

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: Students will learn about various staining procedures for demonstration of different substances. The students will learn about special staining procedures, its handling & testing of various histological specimens in addition to cryostat sectioning and electron microscopic procedures.

Course Objective:
Students will learn about various staining procedures for demonstration of different substances. The students will learn about special staining procedures, its handling & testing of various histological specimens in addition to cryostat sectioning and electron microscopic procedures

Course Outcomes:

- The student should be able to comprehend the histogenetic and patho-physiologic processes, demonstration of morphology (gross and microscopic) associated with various lesions during discussions with colleagues, clinicians, students and patients. Should be able to identify problems in the laboratory and offer viable solutions
- Comprehend principles and procedure of lab techniques and trouble shooting.

Course Content

Module I: Staining techniques in histopathology & identification of different substances

1. Cryostat sectioning, its applications in diagnostic histopathology.

2. Special Staining Procedures for detection of

2.1 Connective tissue elements, Trichrome staining, muscle fibers, elastic, reticulin fibers, collagen fibers etc.

2.2 Metachromatic staining such as Toludine blue on frozen sections

2.3 Principles of metal impregnation techniques.

2.4 Demonstration and identification of minerals and pigments, removal of Pigments/artifacts in tissue sections

3. Demonstration of Proteins & nucleic acids.

4. Demonstration of Carbohydrates, lipids, fat & fat like substances.

Module II: Microbial identification in tissue & enzyme histochemistry

5. Demonstration of bacteria and fungi in tissue section.

6. Tissue requiring special treatment i.e., eye ball, bone marrow, and muscle biopsy, under calcified or unclarified bones, whole brain, and whole lungs including other large organs.

7. Enzyme histochemistry: Diagnostic applications and the demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases.

8. Vital staining.

Module III: Museum techniques & basics of microscope

9. Neuro-pathological techniques.

10. Museum techniques.

11. Electron Microscope:

11.1 working principle and its components

11.2 Processing, embedding and ultra-microtomy

12. Micrometry and Morphometry

Suggested Readings:

1. Handbook of Histopathological Techniques by C F A Culling

2. Medical Lab technology by Lynch

3. An Introduction to Medical Lab Technology by F J Baker and Silverton

4. Bancroft ‘s Theory and Practice of Histopathological Techniques by John D Bancroft

COURSE TITLE: IMMUNOLOGY & BACTERIAL SEROLOGY- Lab

COURSE CODE: MLT43201

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ This section will cover the basic aspects of immunity, antigens, antibodies, various serological reactions, techniques and their utility in laboratory diagnosis of human diseases. It will also cover medically important fungi, infections caused by them and their laboratory diagnosis.

Course Content

List of Experiments

1. Collection of blood sample by vein puncture, separation and preservation of serum

2. Performing Haemolysin titration for Rose-Waaler test

3. Preparation of Phosphate buffers, Verinol buffer, ASO buffer, Richardson ‘s buffer, Buffers of different pH and Molarity, Tris buffer, Standardization of cell concentration by Spectrophotometer

4. Performance of Serological tests i.e.

4.1 Widal,

4.2 Brucella Tube Agglutination,

4.3 VDRL (including Antigen Preparation),

4.4 ASO (Anti-Streptolysin ‘O’)

4.5 C-Reactive Protein (Latex agglutination)

4.6 Rheumatoid factor (RF) Latex agglutination

4.7 Rose Waaler test,

5. Demonstration of antigen/antibody determination by Immuno fluorescence (IF), Immunodiffusion, precipitation in Agarose gel (Ouchterlony), CCIEP, ELISA, SDS - PAGE and Western blotting.

COURSE TITLE: APPLIED HAEMATOLOGY- II - Lab

COURSE CODE: MLT43203

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The students will be made aware of the safety precautions in Haematology, basic concepts of Automation, quantitative assay of coagulation factors, karyotyping etc. and will learn about concepts such as safety precautions, quality assurance, biomedical waste management and automation in haematology. It will also cover bone marrow examination, red cell anomalies, disorder of leucocytes, L.E. cell phenomenon.

Course Content

List oof Experiments

1. Review the morphology of Normal and abnormal RBCs

2. Review the morphology of normal and immature WBCs

3. WBCs anomalies

4. Calculating INR and determining the ISI of thromboplastin

5. Quantitative Factor assays:

5.1 Factor VIII

5.2 Factor IX

5.3 Factor VII

5.4 Factor X

5.5 Factor V

6. Quantification of inhibitors (Bethesda method)

7. APLA: Lupus Anticoagulant (LA)

8. Anti-cardiolipin antibodies (ACA)

9. Perform Euglobulin clot lysis test (ELT)

10. Urea clot solubility test for factor XIII.

COURSE TITLE: APPLIED CLINICAL BIOCHEMISTRY- I - Lab

COURSE CODE: MLT43205

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The students will be taught about Hazards & safety measures in a clinical biochemistry lab, Quality control and quality assurance, Laboratory organization, management Principles of assay procedures and Radioactivity.

Course Content

List of Experiments

1. Estimation of Glucose in Urine and in Blood.

2. Estimation of Protein in Urine and Blood.

3. Estimation of Urea in blood.

4. Estimation of uric acid in blood.

5. Estimation of serum Bilirubin

6. Estimation of Total Cholesterol in blood.

7. Estimation of HDL Cholesterol.

8. Estimation of LDL Cholesterol.

9. Estimation of TG

10. Estimation of Creatinine in Blood

11. Estimation of serum calcium, Inorganic phosphate

12. To measure electrolytes Sodium, Potassium & Chloride.

COURSE TITLE: APPLIED HISTOPATHOLOGY- II - Lab

COURSE CODE: MLT43207

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ Students will learn about various staining procedures for demonstration of different substances. The students will learn about special staining procedures, its handling & testing of various histological specimens in addition to cryostat sectioning and electron microscopic procedures

Course Content

List of Experiments

1. To cut frozen section and stain for Haematoxylin and Eosin, Metachromatic stain Toluidine blue - O and Oil Red O staining for the demonstration of fat

2. To prepare Schiff ‘s reagent in the lab and do Periodic Acid Schiff ‘s (PAS) stain on a paraffin section 3. To prepare ammonical silver bath in the laboratory and stain paraffin embedded section for the demonstration of reticulin fibers.

4. To stain a paraffin section for the demonstration of smooth muscle by Van Gieson ‘s Stain

5. To perform Masson ‘s trichrome stain on a paraffin section for the demonstration of collagen fiber, muscle fiber and other cell elements.

6. To stain the paraffin section for the demonstration of the elastic fibers (EVG).

7. To stain Decalcified paraffin embedded section for the presence of calcium salts (Von Kossa‘s method).

8. To stain a paraffin section for the following Mucicarmine, Alcian blue.

9. To stain a paraffin section for the demonstration of iron (Perl ‘s stain)

10. To demonstrate the presence of bacteria and fungi in paraffin embedded sections using the following staining procedures:

10.1 Gram ‘s staining

10.2 AFB staining (Ziehl Neilson ‘s staining) for M. tuberculosis and leprae

10.3 Grocott‘s stain for fungi

10.4 Schmorl‘s reaction for reducing substances (melanin)

11. To stain for nucleic acid (DNA and RNA)

11.1 Feulgen Staining

11.2 Methyl Green-Pyronin Staining

11.3 Enzymatic methods

GUEST LECTURE/TUTORIAL/SEMINAR/VISIT TO ANY MEDICAL RESEARCH INSTITUTION OR REPUTED CLINICAL

COURSE CODE: MLT43209

COURSE CREDIT: 2

CONTACT HOURS: 30

YEAR – III
SEMESTER – VI

COURSE TITLE: MEDICAL PARASITOLOGY & ENTOMOLOGY

COURSE CODE: MLT43102

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

Course Objective:

- ✓ The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

Course Outcomes:

- ➢ CO1: To develop an understanding of important human parasitic diseases, including their life cycles, vectors of transmission, distribution and epidemiology, pathophysiology and clinical manifestations, treatment, and prevention and control.
- ➢ CO2: To provide students with knowledge concerning biological, epidemiological and ecological aspects of parasites causing diseases to humans.

Course content

Module I: Basics of protozoa and detailed study of different protozoa

1. Introduction to Medical Parasitology with respect to terms used in Parasitology.

2. Protozoology/ Protozoal parasites:

2.1 General characteristics of protozoa.

2.2 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Entamoeba sp.

2.3 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of Intestinal and vaginal flagellates i.e. Giardia, Trichomonas sp.

2.4 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of blood and tissue flagellates i.e. Plasmodium and Toxoplasma sp.

3. Helminthology/ Helminthic parasites:

3.1 General characteristics of Cestodes, Trematodes and Nematodes

3.2 Geographical distribution, Habitat, Morphology, life cycle, Mode of infection and laboratory diagnosis of:

3.2.1 Taenia solium and saginata

3.2.2 Echinococcus granulosus

3.2.3 Hymenolepis nana

3.2.4 Schistosoma haematobium and mansoni

3.2.5 Fasciola hepatica and buski

3.2.6 Trichuris trichura

3.2.7 Trichinella spirales

3.2.8 Strongyloidesstercoralis

3.2.9 Ancylostoma duodenale

3.2.10 Enterobius vermicularis

3.2.11 Ascaris lumbricoides

3.2.12 Wuchereria bancrofti

3.2.13 Dracunculus medinensis

Module II: Different diagnostic process for the identification of protozoa

4. Diagnostic procedures:

4.1 Examination of Stool for parasites

4.1.1 For intestinal protozoal infections

4.1.2 General rules for microscopic examination of stool samples

4.1.3 Collection of stool samples

4.1.4 Preparation of material for unstained and stained preparations

4.1.5 Staining methods i.e. Iodine staining and permanent staining

4.1.6 For Helminthic infections

4.1.6.1 Introduction, direct smear preparation and examination

4.1.6.2 Concentration techniques i.e. Flotation and sedimentation techniques

4.1.6.3 Egg counting techniques

4.1.7 Examination of blood for parasites

4.1.7.1 Preparation of thin and thick blood film

4.1.7.2 Leishman staining

4.1.7.3 Examination of thick and thin smear

4.1.7.4 Field‘s stain

4.1.7.5 JSB stain

5. Examination of blood film for Malarial parasite and Microfilariae

6. Collection, Transport, processing and preservation of samples for routine parasitological investigations.

Module III: Detailed study of different parasites

7. Morphology, life cycle and lab-diagnosis of Giardia and Entamoeba

8. Morphology, life cycle and lab-diagnosis of Roundworms and Hookworms

9. Morphology, life cycle and lab-diagnosis of T. solium and T. saginata

Module IV: Laboratory diagnosis of Cyst

10. Morphology, life cycle and lab-diagnosis of Malarial parasite with special reference to P. vivax and P. falciparum

11. Laboratory diagnosis of hydated cyst and cysticercosis

12. Concentration techniques for demonstration of Ova and Cysts (Principles and applications)

Suggested Readings:

1. Parasitology in relation to Clinical Medicine by K D Chhatterjee

2. Medical Entomology by A.K. Hati, Pub. Allied Book Agency

3. Medical Parasitology by D.R. Arora

4. Clinical Parasitology by Paul Chester Beaver

COURSE TITLE: ADVANCED HAEMATOLOGY

COURSE CODE: MLT43104

COURSE CREDIT: 4

Contact hours: 60

Rationale: The students will be made aware of different anaemia, Leukaemia, chromosomal studies, bleeding disorders and radiation hazards

Course Objective:

- ✓ The students will be made aware of different anemia, Leukemia, chromosomal studies, bleeding disorders and radiation hazards

Course Outcomes:

- ➢ CO1: To develop an understanding of important human parasitic diseases, including their life cycles, vectors of transmission, distribution and epidemiology, pathophysiology and clinical manifestations, treatment, and prevention and control.
- ➢ CO2: To provide students with knowledge concerning biological, epidemiological and ecological aspects of parasites causing diseases to humans.

Course Content

Module I: Laboratory diagnosis of different haematological disorders

1. Laboratory diagnosis of Iron deficiency anaemia

2. Laboratory diagnosis of Megaloblastic anaemia & Pernicious anaemia

3. Classification and Laboratory diagnosis of Haemolytic anaemia

4. Definition, classification and laboratory diagnosis of Leukaemia

Module II: Chromosomal studies of various disorders and measurement of different parameters of blood using radioisotopes

5. Chromosomal studies in various haematological disorders and their significance.

6. Laboratory diagnosis of bleeding disorders with special emphasize to

6.1 Haemophilia A, B & Von-Willebrand disease

6.2 DIC

6.3 Platelet disorder (Qualitative and quantitative)

7. Laboratory approach for investigating thrombosis.

8. Using radioisotopes measurement of:

8.1 Blood volume

8.2 Determination of Red cell volume and Plasma volume

8.3 Red cell life span

8.4 Platelet life span

8.5 Radiation hazards and its prevention

8.6 Disposal of radioactive material

Suggested Readings:

1. Text book of Medical Laboratory Technology by Paraful B. Godkar

2. Medical laboratory Technology by KL Mukherjee Volume-I

3. Practical Haematology by JB Dacie

4. Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henary

5. Atlas of Haematology (5th edition) by G.A. McDonald

6. De Gruchy's clinical Haematology in medical practice

7. Postgraduate Haematology by Hoffbrand

COURSE TITLE: APPLIED CLINICAL BIOCHEMISTRY - II

COURSE CODE: MLT43106

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will learn how to analyze various clinical patients 'samples, for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important enzymes & automation techniques.

Course Objective:

- ✓ The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important enzymes & automation techniques.

Course Outcomes:

- CO1: Discuss the fundamental biochemistry knowledge related to health
- CO2: Explain the clinical significance of the laboratory tests
- CO3: Diagnosis of clinical disorders by estimating biomarkers
- CO4: Determine various substances including substrates, enzymes, hormones, etc and their use in diagnosis and monitoring of disease are applied
- CO5: Evaluate the abnormalities which commonly occur in the clinical field.

Course Content

Module I: Estimation & assessment of different biochemical substances

1. Automation in clinical biochemistry

2. Method of estimation and assessment for:

2.1 Glucose tolerance test

2.2 Insulin tolerance test

2.3 Xylose excretion test.

3. Gastric analysis.

Module II: Renal function & qualitative test for different substances

4. Clearance test for renal function.

5. Qualitative test for:

5.1 Urobilinogen

5.2 Barbiturates

5.3 T3, T4 and TSH

5.4 Ketosteroids

Module III: Principle, procedure and clinical significance of different enzymes

6. Enzymes:

6.1 Principles

6.2 Clinical significance and

6.3 Procedures for estimation

6.3.1 Acid phosphatase

6.3.2 Alkaline phosphatase

6.3.3 Lactate dehydrogenase

6.3.4 Aspartate transaminase

6.3.5 Alanine transaminase

6.3.6 Creatine phosphokinase

7. Qualitative analysis of Renal calculi.

8. Chemical examination of Cerebrospinal fluid.

9. Brief knowledge about rapid techniques in clinical biochemistry

Suggested Readings:

1. Text book of Medical Laboratory Technology by P.B. Godkar.

2. Medical Laboratory Science, Theory & Practical by A. Kolhatkar.

3. Practical Clinical Biochemistry by Harold Varley.

4. Biochemistry, U. Satyanarayan & U. Chakrapani.

5. Text book of Medical Biochemistry by Chaterjee&Shinde.

6. Principal of Biochemistry by Lehninger

7. Biochemistry by Voet & Voet

8. Biochemistry by Stryer

COURSE TITLE: CYTOPATHOLOGY THEORY

COURSE CODE: MLT43108

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures &handling & testing of various cytological specimens.

Course Objective:

- ✓ The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures &handling & testing of various cytological specimens.

Course Outcomes:

- ➢ Be able to explain the evaluation of cell and the variety of cells occurring this progression.
- ➢ Be able to list and define of chemical and biological components of cell contents.
- ➢ Be able to explain structure and functions of cell membrane and organelles.

Course Content

Module I: Cryostat sectioning & enzyme cytochemistry

1. Cryostat sectioning, its applications in diagnostic cytopathology

2. Enzyme Cytochemistry:

2.1 Diagnostic applications

2.2 Demonstration of Phosphatases, Dehydrogenases, Oxidases & Peroxidases

3. Vital staining for Sex Chromatin

Module II: Aspiration & exfoliative cytology and automation in cytology

4. Aspiration cytology:

4.1 Principle

4.2 Indications & utility of the technique with special emphasis on role of cytotechnologist in FNAC clinics

5. Exfoliative cytology (Papanicolaou technique for the staining of cervical smears)

5.1 Cervical cytology

5.2 Fluid Cytology

5.2.1 Urine

5.2.2 CSF

5.2.3 Body Fluids (Pleural, Pericardial, Ascitic)

6. Automation in cytology

7. Liquid based cytology: Principles and preparation, Cytocentrifuge, molecular cytology, Cell Block and Immune-cytochemistry

Suggested Readings:

1. Handbook of Histopathological Techniques by C F A Culling

2. Medical Lab technology by Lynch

3. An Introduction to Medical Lab Technology by F J Baker and Silverton

4. Bancroft ‘s Theory and Practice of Histopathological Techniques by John D Bancroft

5. Diagnostic Cytology by Koss Volume -II

COURSE TITLE: MEDICAL PARASITOLOGY & ENTOMOLOGY - Lab

COURSE CODE: MLT43202

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various medically important parasites.

Course Content

List of Experiments

1. Routine stool examination for detection of intestinal parasites with concentration methods:

1.1 Saline preparation

1.2 Iodine preparation

1.3 Floatation method

1.4 Centrifugation method

1.5 Formal ether method

1.6 Zinc sulphate method

2. Identification of adult worms from models/slides:

2.1 Tapeworm

2.2 Tapeworm segments

2.3 Ascaris (Round worm)

2.4 Hookworms

2.5 Pinworms

3. Malarial parasite:

3.1 Preparation of thin and thick smears

3.2 Staining of smears

3.3 Examination of smears for malarial parasites (P. vivax and P. falciparum)

COURSE TITLE: ADVANCED HAEMATOLOGY - Lab

COURSE CODE: MLT43204

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The students will be made aware of different anemia, Leukemia, chromosomal studies, bleeding disorders and radiation hazards

Course Content

List of Experiments

1. Study and interpretation of Histogram of Automated Blood cell counter

2. To estimate serum iron and total iron binding capacity.

3. Screening tests for enzymes deficiency: Pyruvate Kinase, G6PD

4. To estimate Hb-F, Hb-A2 in a given blood sample.

5. To estimate plasma and urine Hemoglobin in the given specimens.

6. To demonstrate the presence of Hb-S by Sickling and Solubility tests.

7. Perform Hb electrophoresis (alkaline)

8. Perform osmotic red cell fragility.

9. Detection of Fibrin degradation products (FDPs)

10. To perform various platelet function tests such as whole blood clot retraction test, prothrombin consumption index (PCI) Platelet adhesion, aggregation and PF3 availability test.

11. Estimation of Protein C, S

12. Peripheral Blood Lymphocyte Culture for chromosome studies in Leukemia.

COURSE TITLE: APPLIED CLINICAL BIOCHEMISTRY-II - Lab

COURSE CODE: MLT43206

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important enzymes & automation techniques.

Course Contents

List of Experiments

1. Estimation of Glucose tolerance test (GTT).

2. Estimation of Insulin tolerance test (ITT).

3. Determination of Uric acid in Urine.

4. Determination of Creatinine clearance.

5. Determination of Urea clearance.

6. Determination of Serum acid phosphatase.

7. Determination of Serum Alkaline phosphatase.

8. Determination of Serum Lactate dehydrogenase.

9. Determination of T3, T4 and TSH

COURSE TITLE: CYTOPATHOLOGY - Lab

COURSE CODE: MLT43208

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The students will learn about various staining procedures for demonstration of different substances & various cytological investigations. This will include special staining procedures &handling & testing of various cytological specimens.

Course Content

List of Experiments

1. To perform Papnicolaou‘s stain on cervical smear

2. To perform Guard ‘s staining for demonstration sex chromatin (Barr bodies on a buccal smear)

3. To perform Shorr‘s staining for Hormonal assessment

4. To cut frozen sections of Gynaec tissue

5. To perform CSF sample and body fluids by cytospin

6. Should know the various stains used in Cytology lab:May Grunwald Giemsa, H&E, PAS, Grocott‘s.

GUEST LECTURE/TUTORIAL/SEMINAR/VISIT TO ANY MEDICAL RESEARCH INSTITUTION OR REPUTED CLINICAL

COURSE CODE: MLT43210

COURSE CREDIT: 2

CONTACT HOURS: 30

YEAR – IV

SEMESTER – VII

COURSE TITLE: MEDICAL MYCOLOGY AND VIROLOGY

COURSE CODE: MLT44101

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various Medically important Fungi and Viruses.

Course Objective:

- ✓ The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various Medically important Fungi and Viruses.

Course Outcomes:

- CO1: Students will be able to understand the structure, characteristics and classification of virus and fungus.
- CO2: Plan, write and implement research projects in virology and mycology analyze their results and publish these in peer-reviewed journals.
- CO3: Coordinate with concerned agencies regarding viral and fungal diseases and their outbreaks.
- CO4: Plan and execute epidemiological studies and provide advice in relation to viral diseases.

Course Content

Virology:

Module I: Basics of viruses and their multiplication

1. Introduction to medical virology

2. Introduction to medically important viruses

3. Structure and Classification of viruses.

4. Multiplication of viruses

Module II: Sample collection, processing and staining for rapid diagnosis of virus

5. Collection, transportation and storage of sample for viral diagnosis

6. Staining techniques used in Virology

7. Processing of samples for viral culture (Egg inoculation and tissue culture)

8. Rapid diagnosis of viral infections with special reference to HIV, HBV and HCV

8.1 EIA

8.2 Immunofluorescence

8.3 PCR

Mycology:

Module I: Detailed study of various medically important fungi and fungal laboratory contaminants

1. Introduction to Medical Mycology

2. Basic concepts about superficial and deep Mycoses

3. Taxonomy and classification and general characteristics of various medically important fungi

4. Normal fungal flora

5. Morphological, cultural characteristics of common fungal laboratory contaminants

Module II: Culture media for fungi & processing of different samples for diagnosis of fungal infection

6. Culture media used in mycology

7. Direct microscopy in medical mycology laboratory

8. Processing of clinical samples for diagnosis of fungal infections i.e. Skin, nail, hair, pus, sputum, CSF and other body fluids

9. Techniques used for isolation and identification of medically important fungi

Module III: Yeast and moulds identification, antifungal susceptibility tests

10. Methods for identification of yeasts and moulds

11. Dimorphism in fungi

12. Antifungal susceptibility tests

13. Preservation of fungal cultures

14. Routine myco-serological tests and skin tests

Suggested Readings:

1. Practical Medical Microbiology by Mackie &MacCartney Volume 1 and 2

2. Text book of Microbiology by Anantha narayanan

3. Medical Microbiology by Panikar & Satish Gupte

4. Medical laboratory Technology Vol. I ,II, III by Mukherjee

5. Medical Laboratory manual for tropical countries Vol. II Microbiology by Monica Chees brough

6. Medical Mycology by Dr. Jagdish Chander

COURSE TITLE: BLOOD BANKING & GENETICS

COURSE CODE: MLT44103

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: Blood banking will make students learn about blood grouping & blood transfusion. The students will learn about the concept of blood grouping, compatibility testing in blood transfusion & screening of donated blood for various infectious diseases. Genetics will make students learn about Fundamentals of Heredity. The students will learn about the concept of inheritance in various genetic diseases.

Course Objective:

- ✓ Blood banking will make students learn about blood grouping & blood transfusion. The students will learn about the concept of blood grouping, compatibility testing in blood transfusion & screening of donated blood for various infectious diseases.

Course Outcomes:

- ➢ CO1: The student would be able to produce knowledge of testing procedure.
- ➢ CO2: Students would be able to produce instrument knowledge.

Course Content

Blood Banking

Module I: Basics of blood banking and blood grouping

1. Introduction to Blood Banking

2. History and discovery of various blood group systems

3. ABO blood group system

4. Rh and other major blood group system

Module II: ABO and Rh grouping, compatibility test in blood transfusion

5. Sources of error in blood grouping and their elimination.

6. ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and reverse grouping

7. Rh grouping

8. Compatibility test in blood transfusion

8.1 Collection of blood for cross matching from a blood bag

8.2 Major cross matching

8.3 Minor cross matching

8.4 Use of enzymes in blood bank specially Papain

Module III: Laboratory investigation and precautions of transfusion reaction

9. Complications and hazards of blood transfusion

10. Laboratory investigations of transfusion reactions and mismatched blood transfusion.

11. Precautions while procurement and storage of grouping antisera

12. Various anticoagulants used to collect blood for transfusion purposes

13. Selection of donor and procedure for collection of blood from a healthy donor

Module IV: Different blood components and their preparation

14. Preparation of various fractions of blood for transfusion and therapeutic purposes such as:

14.1 Packed red cells, washed red cells and FROZEN Red cells

14.2 Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets.

14.3 Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate

15. Brief introduction of blood substitute/artificial blood

16. Haemopheresis: pertaining to Leucocytes, platelets and plasma.

17. Quality control in blood bank

Genetics

Module I: Chromosomes, molecular genetics and microbial genetics

1. Continuity of life-heredity, variation;

2. Mendel's laws of inheritance,

3. Chromosomal basis of inheritance; other patterns of inheritance- incomplete dominance, multi parallelism, quantitative inheritance.

4. Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination;

5. Molecular genetics: DNA as a genetic material- its structure and replication; structure of RNA and its role in protein synthesis, Vectors, plasmids

6. Human Genetics

7. Microbial genetics

Suggested readings:

1. Practical Haematology by J.B. Dacie

2. Transfusion Science by Overfield, Hamer

3. Medical Laboratory Technology by K.L. Mukherjee Volume-I

4. Mollison's Blood Transfusion in Clinical Medicine, 12th Edition by Harvey G. Klein

5. Genes by Benjamin Lewin

6. Genetics by B.D. Singh

7. Principals of Genetics by Gardner 8. Instant Noteson Genetics by PC Winter, GI Hickey and HL Fletcher

COURSE TITLE: IMMUNOPATHOLOGY & MOLECULAR BIOLOGY

COURSE CODE: MLT44105

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The students will learn how to analyze various clinical patients'samples, for estimation of different components which are the cause of the immune disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important cells of immune system, lymphoid organs, antigen, antibody, Ag-Ab. reactions, transplant immunology etc. & automation techniques. Molecular biology concerns the molecular basis of 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. A basic introduction of molecular biology and its techniques like PCR, RTPCR etc. will also be rendered to sensitize students to take up future molecular biology challenges.

Course Objective:

- ✓ The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the immune disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important cells of immune system, lymphoid organs, antigen, antibody, Ag-Ab. reactions, transplant immunology etc. & automation techniques. Molecular biology concerns the molecular basis of 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. A basic introduction of molecular biology and its techniques like PCR, RTPCR etc. will also be rendered to sensitize students to take up future molecular biology challenges.

Course Outcomes:

- ➢ CO1: The student would be able to understand PCR test.
- ➢ CO2: Students would be able to understand to analyze various clinical patients' samples, for estimation of different components which are the cause of the immune disease.

Course Content

Module I: Basics of immune system and immune response

1. Introduction to Immunology

2. Cells of the immune system

3. Types and Mechanisms of immune response

4. Lymphoid organs of the Immune system

5. MHC I & II

Module II: Hypersensitivity & autoimmunity

6. HLA Typing & Cross matching

7. Transplant Immunology

8. Hypersensitivity: Definition, Types, Mechanisms

9. Autoimmunity

10. Immune tolerance: Basic concepts

Module III: Basics of molecular biology and various molecular biology techniques & their detailed study

11. Introduction to Molecular Biology

12. Relationship of Mol. Biology with other Science

13. Molecular Biology Techniques: Principle, Reagents used, procedure and applications in medical diagnostics

13.1 Polymerase Chain Reaction and its advanced versions

13.2 Gel electrophoresis

13.3 Western blotting

14. Chemical composition of DNA

14.1 DNA replication

14.2 DNA damage and repair

14.3 Regulation of prokaryotic and eukaryotic gene expression

14.4 Cell Cycle

Suggested Readings:

1. Immunology by Ivan Roitt, Jonathaan Brostoff and David Male

2. Immunology by Kuby

3. Medical Immunology by Daniel P Stites

4. Basic & Clinical Immunology by P. Daniel Fudenberg. H. Hugh and Stites

5. Elements of Biotechnology by PK Gupta

6. Watson Molecular Biology of Gene

7. Advanced Molecular Biology by R Twyman

8. Principal of Biochemistry by Lehninger

COURSE TITLE: RESEARCH METHODOLOGY AND BIOSTATISTICS

COURSE CODE: MLT44107

COURSE CREDIT: 4

CONTACT HOURS: 60

Rationale: The objective of this module is to help the students understand the basic principles of research and methods applied to draw inferences from the research findings. The students will also be made aware of the need of biostatistics and understanding of data, sampling methods, in addition to being given information about the relation between data and variables.

Course Objectives:

- ✓ To familiarize participants with basic of research and the research process.
- ✓ To enable the participants in conducting research work and formulating research synopsis and report.
- ✓ To familiarize participants with Statistical packages such as SPSS/EXCEL.

Course Outcomes:

- ➢ CO1: Develop the ability to apply the methods while working on a research project work
- ➢ CO2: Describe the appropriate statistical methods required for a particular research design
- ➢ CO3: Choose the appropriate research design and develop appropriate research hypothesis for a research project
- ➢ CO4: Develop an appropriate framework for research studies.

Course Content

Research Methodology:

Module I: Basics of research, ethical issues in research and design of research

1. Introduction to research methods

2. Identifying research problem

3. Ethical issues in research

4. Research design

Module II: Research tools, types of data and their collection

5. Basic Concepts of Biostatistics

6. Types of Data

7. Research tools and Data collection methods

8. Sampling methods

9. Developing a research proposal

Biostatistics:

Module I: Basics of biostatistics, concept of relevant data

1. Need of biostatistics

2. What is biostatistics: beyond definition

3. Understanding of data in biostatistics

4. How & where to get relevant data

5. Relation between data & variables

Module II: Concept of variables & statistical analysis

6. Type of variables: defining data set

7. Collection of relevant data: sampling methods

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

9. Summarizing data on the pretext of underlined study

10. Understanding of statistical analysis (not methods)

Suggested readings:

1. Statistical Methods by S.P. Gupta

2. Methods in biostatistics for medical students by B.K. Mahajan

3. RPG Biostatistics by Himanshu Tyagi

COURSE TITLE: MEDICAL MYCOLOGY AND VIROLOGY - Lab

COURSE CODE: MLT44201

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The student will be taught about introduction, general characteristics, life cycle and laboratory diagnosis of various Medically important Fungi and Viruses.

Course Content

List of Experiments

1. To prepare culture media used routinely in mycology

2. To perform KOH preparation, Gram stain, Potassium Hydroxide - Calcofluor White method, India Ink preparation, Modified Kinyoun Acid Fast Stain for Nocardia, LCB preparation.

3. To identify given yeast culture by performing various identification techniques studied in theory.

4. To identify given mould culture by performing various identification techniques studied in theory.

5. To demonstrate dimorphism in fungi

6. To collect and process clinical samples for laboratory diagnosis of fungal infections i.e.

6.1 Skin

6.2 Nail

6.3 Hair

6.4 Body fluids and secretions

7. To demonstrate structure of viruses and their multiplication from charts etc.

8. To perform Giemsa stain, Seller ‘s stain, immunofluorescent staining procedures for diagnosis of viral infections

9. Demonstration of fertilized hen egg

10. Demonstration of various inoculation routes in fertilized hen egg

COURSE TITLE: BLOOD BANKING AND GENETICS - Lab

COURSE CODE: MLT44203

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ Blood banking will make students learn about blood grouping & blood transfusion. The students will learn about the concept of blood grouping, compatibility testing in blood transfusion & screening of donated blood for various infectious diseases.

Course Content

List of Experiments

1. To prepare Acid Citrate Dextrose (ACD) and Citrate Phosphate Dextrose (CPD) Solutions

2. Screening of blood donor: physical examination including medical history of the donor

3. Collection and preservation of blood for transfusion purpose

4. Screening of blood for Malaria, Microfilaria, HBs Ag, Syphilis and HIV

5. To determine the ABO & Rh grouping

5.1 Direct or preliminary grouping

5.2 Indirect or proof grouping

5.3 Rh grouping and determination of Du in case of Rh negative

6. To perform Direct and Indirect Coomb ‘s test

7. To perform cross matching

7.1 Major cross matching

7.2 Minor cross matching

8. Preparation of various fractions of blood.

COURSE TITLE: IMMUNOPATHOLOGY & MOLECULAR BIOLOGY - Lab

COURSE CODE: MLT44205

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objective:

- ✓ The students will learn how to analyze various clinical patients' samples, for estimation of different components which are the cause of the immune disease or are the diagnostic/prognostic markers. This subject gives information about various clinically important cells of immune system, lymphoid organs, antigen, antibody, Ag-Ab. reactions, transplant immunology etc. & automation techniques. Molecular biology concerns the molecular basis of 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. A basic introduction of molecular biology and its techniques like PCR, RTPCR etc. will also be rendered to sensitize students to take up future molecular biology challenges.

Course Content

List of Experiments

1. Peripheral blood mononuclear cell (PBMC) isolation by gradient centrifugation

2. T and B cell separation

3. Immunofluorescence

3.1 Anti- Nuclear Antibody (ANA)

3.2 Anti- Neutrophil Cytoplasmic Antibody (ANCA)

4. AIDS Immunology and Pathogenesis (AIP)

5. Thyroid Microsomal antigen (TMA)- Agglutination reactions

6. Electrophoresis

7. Gel diffusion

8. Nephlometery

9. HLA

9.1 Typing Serology & Cross match

9.2 Molecular Typing

10. Nitro blue Tetrazolium Chloride Test (NBT)

11. FACS for CD4 and CD8

12. ELISA for lab. diagnosis of AIDS

13. Polymerase Chain Reaction and its advanced versions

14. Gel electrophoresis

15. Western blotting

16. Isolation of DNA and RNA

17. Estimation of DNA and RNA

18. Determination of molecular weight and quantification of DNA using agarose gel electrophoresis

COURSE TITLE: RESEARCH METHODOLOGY AND BIOSTATISTICS - Lab

COURSE CODE: MLT44207

COURSE CREDIT: 2

CONTACT HOURS: 30

Course Objectives:

- ✓ To familiarize participants with basic of research and the research process.
- ✓ To enable the participants in conducting research work and formulating research synopsis and report.
- ✓ To familiarize participants with Statistical packages such as SPSS/EXCEL.

Course Content

1. To practice problems on various biostatistics tools.

GUEST LECTURE/TUTORIAL/SEMINAR/VISIT TO ANY MEDICAL RESEARCH INSTITUTION OR REPUTED CLINICAL

COURSE CODE: MLT44209

COURSE CREDIT: 2

CONTACT HOURS: 30

YEAR – IV
SEMESTER – VIII

COURSE TITLE: INTERNSHIP

COURSE CODE: MLT44202

COURSE CREDIT: 26

CONTACT HOURS: 720

The internship will span 6 months/ 1 semester. This will include 6 hours of practice a day, totalling to 720 hours during internship semester. As a part of this, the students will maintain a work log book which will be duly endorsed by the supervisor or trainer. At the end of internship, the candidate shall submit the work log book along with certificate from the training institute. Finally, the training of candidate shall be evaluated by the internal and external examiners deputed by University/Board in the form of practical / viva examination.

The internship time period provides the students the opportunity to continue to develop confidence and increased skill in clinical delivery of services. Students will demonstrate competence in beginning and intermediate procedures. Students will observe the advanced and specialized procedures. The student will complete the clinical training by practicing all the skills learned in classroom and clinical instruction. The students are expected to work for minimum 6 hours per day and this may be more depending on the need and the healthcare setting.

Skills based outcomes and monitorable indicators for Medical Laboratory Scientist

1. Demonstrate professional interpersonal, oral, and written communications skills sufficient to serve the needs of patients and the public including an awareness of how diversity may affect the communication process.

2. Perform pre-analytical, analytical, and post-analytical processes:

2.1 Demonstrate ability to understand investigation/test requisition.

2.2 Collecting the relevant clinical samples along with complete and accurate documentation with proper safety measures in relation to sample accountability.

2.3 To transport the samples with precautionary measures to the relevant lab section.

2.4 Demonstrate the ability to prepare clinical sample for processing.

2.5 To demonstrate the knowledge of accurate sample processing for the required lab investigation. Perform routine clinical laboratory tests in clinical chemistry, haematology/haemostasis, immunology, immune haematology, microbiology, Histopathology, Cytopathology, body fluid analysis, and laboratory operations.

2.6 Perform mathematical calculations related to all areas of the clinical laboratory

2.7 Ability to record the test results/data.

2.8 To demonstrate the ability to interpret the test reports and its documentation in lab records.

2.9 Demonstrate ability to release the report to the right person in minimum turn-around time (TAT).

3. Perform problem solving and troubleshooting techniques for laboratory methodologies Correlate laboratory test results with patient diagnosis and treatment.

4. To follow basic quality assessment protocol of clinical laboratory.

5. Demonstrate routine laboratory techniques sufficient to orient new employees within the clinical laboratory.

6. Apply basic scientific principles in learning new techniques/procedures; demonstrate application of principles and methodologies.

7. Utilize computer technology applications to interact with computerized instruments and laboratory information systems.

8. Demonstrate adequate knowledge of computer software as it applies to document production, spreadsheets, and presentations.

9. Demonstrate professional behaviour with co-team mates.

10. Demonstrate sensitivity and compassion towards patients.