

Medical Lab Technology

CLINICAL MICROBIOLOGY- IV

(Immunology and mycology)

L T P
3 - 4

RATIONALE

The students undergoing training of medical laboratory technology learn the techniques of collection of samples, their processing and identification of various fungal infections and diagnosis of microbial infections by serological methods. In addition to the above, students are given training in the use of safety measures while handling infected materials. The training is aimed to make the students competent to isolate and identify fungi and do serological tests for various microbial infections.

DETAILED CONTENTS

1. Mycology (4 hrs)
 - Characteristics and classification of medically important fungi
- 2 Fungal Culture media (2 hrs)
 - SDA (Sabouraud's dextrose agar) with and without antibiotics
 - CMA (Corn meal agar)
 - RSA (Rice Starch Agar)
- 3 Fungal Staining (2 hrs)
 - KOH preparation
 - LCB (Lactophenol cotton blue)
- 4 Fungal Cultivation (6 hrs)
 - Medically important fungi - Candida, Dermatophytes and Aspergillus
 - Laboratory Contaminants – Penicillium, Rhizopus, Mucor
5. Introduction to Immunology (6 hrs)
Immunity:
 - Innate and
 - Acquired
6. Antigens (4 hrs)
 - Definition, types and properties
- 7 Antibodies (4 hrs)
 - Definition, types and properties

- 8 Antigen – Antibody Reactions (6 hrs)
- Principle and applications of agglutination, precipitation and flocculation reactions
- 9 Serological tests (8 hrs)
- I Principle, techniques and interpretation of
- Widal - Tube method
 - Anti streptolysin O
 - C-reactive protein
 - VDRL
- II Principle, techniques and Interpretations of (6 hrs)
- Latex agglutination
 - ELISA
 - Widal – latex method

LIST OF PRACTICALS

Preparation of different culture media used in mycology - Sabouraud's dextrose agar with and without antibiotics, Corn meal agar, Rice Starch Agar (RSA)

To perform staining techniques – KOH, LCB

To study characteristics of common laboratory fungal contaminants

Collection and processing of samples for diagnosis of fungal infections in skin, hair, nail scrapings

To perform serological tests

- Widal test (Both slide and tube method)
 - ASO (slide and tube method)
 - CRP (slide and tube method)
 - RA-Slide method
- VDRL Test (slide and tube method)
- HIV Test – Strip/Test card method
 - HBsAg Test- Strip/ Test card method

INSTRUCTIONAL STRATEGY

The teacher should describe the morphology of important pathogenic and non-pathogenic fungi. The students should be taught to collect and process samples for isolation and identification of fungi. The teacher should emphasize on antigen and antibody tests and quality control in microbiology. The students should be taught with illustrations/audio-visual aids.

RECOMMENDED BOOKS

1. Medical Laboratory Technology by Kanai Lal Mukherjee; Tata McGraw Hill Publishers, New Delhi
2. An introduction to Medical Laboratory Technology by FJ Baker; Butterworth Heinemann Oxford
3. Textbook of Microbiology by Ananthanarayan and Panikar; Orient Longman, Hyderabad
4. Practical Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
5. Text Book of Medical Microbiology by Satish Gupta; JP Brothers, New Delhi
6. Medical Laboratory Manual for Tropical Countries Vol. I and II by Monica Cheesberg; Cambridge University Press; UK
7. Text Book of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House; Mumbai
8. Medical Lab Science Theory and Practice by J Ochei and A Kolhatkar
9. Text Book of Medical Microbiology by Greenwood, ELBS

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	4	8
2	2	8
3	2	8
4	6	10
5	6	12
6	4	8
7	4	8
8	6	12
9	8	14
10	6	12
Total	48	100

4.2 HAEMATOLOGY - IV

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RATIONALE

This subject aims to enable the students to carry out routine clinical laboratory investigation (blood, urine etc). He/she should be able to provide technical help for sophisticated hematological techniques with adequate knowledge of various principles. The training in laboratory safety is also provided.

DETAILED CONTENTS

Theory

1. Introduction to normal haemostasis (22 hrs)
 - 1.1 Theories of blood coagulation
 - 1.2 Platelets and their role in haemostasis
 - 1.3 Bleeding disorders and related diseases
 - 1.4 Principles, clinical importance, reference values and methods of: prothrombin time, prothrombin time index (PTI) International normalized ratio (INR), Activated Partial Thromboplastin time (APTT) – bleeding time (BT), Hess test, clotting time (CT), and clot retraction test (CRT)
2. Bone – marrow (5 hrs)
 - 2.1 Composition and function of bone-marrow
 - 2.2 Aspiration of bone-marrow by various methods
 - 2.3 Preparation, staining and examination of bone-marrow smears
 - 2.4 Iron staining (Perls' reaction)
 - 2.5 Significance of bone-marrow examination
3. Leukemia (10 hrs)
 - 3.1 Definition of leukemias
 - 3.2 Classification (FAB)
 - 3.3 Laboratory diagnosis of various leukemias
4. LE Cell phenomenon (3hrs)
 - 4.1 Phenomenon of LE cell, its differentiation from tart cell
 - 4.2 Demonstration of LE cell by various methods
 - 4.3 Clinical importance
5. Processing of biological fluids and interpretation of results (8 hrs)
such as semen, CSF, pleural and ascitic fluids, urine

LIST OF PRACTICALS

Determination of bleeding time by Ivy's and Dukes method
Determination of clotting time by Lee and white and capillary method
Determination of prothrombin time, index and INR (International Normalised Ratio)
Determination of Activated Partial thrombo plastin time (APTT)
Demonstration of Hess test
Performance of Clot retraction test
Demonstration of LE Cell
Processing of biological body fluids

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually.

Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

Medical Laboratory Technology Vol. 1 by KL Mukherjee; Tata McGraw Hill Publishing Company, New Delhi
An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Heinemann, Oxford
Medical Laboratory Manual for Tropical Countries by Monica Cheesberg; Cambridge University Press; UK
Textbook of Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai
Practical Haematology by J.V Decie; ELBS with Churchill Living Stone, UK
Medical Laboratory Science Theory and Practical JO Chei and Kolhatkar, Tata McGraw Hill Publishing Company Ltd., New Delhi
Haematology for Medical Technologists by Charles F. Seiverd 5th Ed. 1983, Lea & Febigue Philadelphia

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	22	46
2	5	10
3	10	21
4	3	6
5	8	17
Total	48	100

4.3 CLINICAL BIOCHEMISTRY- IV

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RATIONALE

The students are imparted basic training of theoretical and practical aspects in the field of clinical biochemistry. The students are made to learn the technique of collection of clinical samples and their processing along with recording of data. The student will also obtain the basic knowledge of chemistry and metabolism of various metabolites which are routinely estimated in different diseases so that a clear understanding of different tests is obtained. The students are also given basic training in safety measures, quality control and automation

DETAILED CONTENTS

Theory

1. Urine Analysis (11hrs)
 - 1.1 Normal composition of urine and its properties
 - 1.2 Clinical importance of urine analysis
 - 1.3 Qualitative analysis of proteins, sugar, bile salts, bile pigments, urobilinogen and blood.
 - 1.4 Detailed discussion on glycosuria and albuminuria
 - 1.5 Ketone bodies, 17 Ketosteroids

2. Stool Chemistry (8 hrs)
 - 2.1 Physical characteristics and chemical composition of stool
 - 2.2 Significance of presence of blood and excess fat in stool
 - 2.3 Occult blood detection

3. Cerebrospinal Fluid (5 hrs)
 - 3.1 Composition and functions of CSF
 - 3.2 Methods of determination of proteins, sugar and chloride in CSF
 - 3.3 Reference Values
 - 3.4 Clinical importance

4. Biological fluids (5 hrs)

Formation, composition and significance of biological fluids (peritoneal, pleural, synovial, ascitic fluid and gastric juice)

5. Electrophoresis (4 hrs)
 - 5.1 Theory
 - 5.2 Principle and procedure of paper, gel electrophoresis, method of elution
 - 5.3 Clinical importance

6. Chromatography (4 hrs)
- 6.1 Theory of Chromatography, separation between stationary and mobile phases
 - 6.2 Principle and procedure of Paper chromatography
 - 6.3 Importance of chromatography
7. Automation in Biochemistry (5 hrs)
8. Thyroid function tests (6 hrs)
- 8.1 Functions of thyroid
 - 8.2 Principle, reference values and clinical importance of T₃, T₄ and TSH

LIST OF PRACTICALS

1. Analysis of urine for sugar and proteins (qualitative and quantitative)
2. Detection of ketone bodies in urine
3. Detection of haematuria
4. Detection of bile pigments, bile salts and urobilinogen
5. Occult blood test for stool specimen
6. Estimation of glucose in CSF
7. Estimation of total proteins and globulins in CSF
8. Estimation of chloride in CSF
9. Titration for acidity determination and qualitative analysis of gastric juice
10. Demonstration of electrophoresis (Paper electrophoresis)
11. Demonstration of chromatography (Paper chromatography)

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually.

Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

A Procedure Manual for Routine Diagnostic Tests, Vol. I, II and III by KL Mukherjee;

Tata McGraw Hill Publishers, New Delhi

Practical Clinical Biochemistry by Varley; Heinmann Publishers, Oxford

A Text Book of Medical laboratory Technology by P Godkar; Bhalani Publishers,
Mumbai

Medical Laboratory Science Theory and Practice by J Ochaei and A Kolhatkar, Tata
McGraw Hill

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	11	20
2	8	16
3	5	10
4	5	10
5	4	10
6	4	10
7	5	10
8	6	14
Total	48	100

4.4 HISTOPATHOLOGY AND CYTOLOGY - II

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RATIONALE

This part of the subject is aimed at exposing the students to the latest advancements and automation in the field of histopathology and cytology.

DETAILED CONTENT

Theory

1. Light Microscope (11 hrs)
 - 1.1 Principles of light microscope
 - 1.2 Various parts of microscope
 - 1.3 Uses of microscope
 - 1.4 Cleaning and maintenance of microscope
 - 1.5 Various attachments of light microscope (introduction only)
 - Polarizing
 - Dark field
 - Phase contrast
 - Fluorescent
2. Special stains (11 hrs)
 - 2.1 Principle, significance and interpretation of different types of stains
 - PAS
 - Silver impregnation stain – Reticulin fibre
 - Ziehl Neelson's – for AFB and Leprae
 - Masson's trichrome stain
 - Pearl's Prussion Blue – Iron
 - Oil Red O – fat
 - Gram's stain – Gram +ve and Gram –ve
3. Decalcification (6 hrs)
 - 3.1 Process of decalcification
 - 3.2 Various types of decalcifying methods
 - 3.3 Their mechanism, advantage, disadvantage and applications
 - 3.4 Assessment of decalcification
4. Handling of fresh histological tissues (Frozen Section) (6 hrs)
 - 4.1 Reception and processing of frozen tissue
 - 4.2 Freezing microtome and cryostat
 - 4.3 Advantages and dis-advantages of freezing microtome and cryostat
 - 4.4 Working, care, maintenance of freezing microtome and cryostat
 - 4.5 Frozen section cutting
 - 4.6 Staining
 - Rapid H&E
 - Fat stain
 - 4.7 Mounting of frozen section

5. Museum Techniques (10 hrs)
 - 5.1 Introduction to museum with emphasis on importance of museum
 - 5.2 Reception, fixation and processing of various museum specimens
 - 5.3 Preparation of mounting solutions
 - 5.4 Technique of mounting specimen
 - 5.5 Care of mounted specimen
 - 5.6 Cataloguing of museum specimen

6. Autopsy (2 hrs)
 - 6.1 Introduction to autopsy technique
 - 6.2 Use of autopsy

7. Malignant Cells (2 hrs)
 - 7.1 Characteristics
 - 7.2 Differences from normal cell

8. Harmonal Assessment (2 hrs)
 - 8.1 Introduction
 - 8.2 Uses

9. Sex Chromatin (Barr bodies) (2 hrs)
 - 9.1 Introduction
 - 9.2 Collection of sample
 - 9.3 Staining
 - 9.4 Interpretation

10. Aspiration Cytology (6 hrs)
 - 10.1 Principle of FNAC (Fine Needle Aspiration Cytology)
 - 10.2 Indications of FNAC
 - 10.3 Uses of FNAC
 - 10.4 Staining Techniques
 - MGG (May-Grunwald – Giemsa)
 - PAP (Papanicolaou Stain)
 - H&E (Haematoxylin & Eosin Stain)

11. Cytological special stains (4 hrs)

Principle, Technique & Interpretation of

 - 11.1. PAS (Periodic Acid Schiffs reagent Stain)
 - 11.2. Zeihl Neelson's(ZN) Stain (AFB)

12. Advancement (2 hrs)
 - 12.1 Automation in Cytology- Use of Cytospin

LIST OF PRACTICALS

1. Demonstration of various parts of light microscope (Mechanical & Optical)
2. Demonstration of cryostat
3. Processing of tissue for frozen section
4. Staining and mounting of frozen section using H&E stain (rapid method), Oil Red “O”.
5. Preparation of various mounting reagents for museum specimens
6. Demonstration and care of autopsy instruments
7. Demonstration of malignant cell
8. Preparation, Staining and interpretation of buccal smear
9. Preparation of dry smear and wet smear
10. To perform Pap stain
11. Fixation of smears and staining with MGG

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually.

Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

An Introduction to Medical Laboratory Technology by FJ Baker; Butterworths Scientific, London

Carleton's Histological Technique by RAB, Drury, MADM (OXON), FRC Path, Northwick Paru Hospital, Harrow, Middlesex

Theory and Practice of Histological Technique by John D. Bancroft, Churchill Livingstone, London

Cellular Pathology Techniques by CFA Culling, Butterworths, London

Medical Lab Technology by Dr. Ramnik Sood, MD, Maulana Azad College, New Delhi

Diagnostic Cytology and its Histopathology Basis by Leo Pold G.Koss; JB Lupein, Philadelphia

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	11	18
2	11	18
3	06	08
4	06	08
5	10	17
6	02	03
7	02	03
8	02	04
9	02	03
10	06	08
11	04	06
12	02	04
Total	64	100

4.6 MEDICAL LABORATORY MANAGEMENT

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RATIONALE

The students are taught techniques of planning a clinical laboratory. They are also supposed to be taught how to procure chemicals, reagents and equipment. The students are imparted special training in maintaining laboratory equipment, the preventive maintenance and daily up keeping. They are also given training for the maintenance of stocks and inventory. They are also given knowledge of recording results, interpretation, quality control and reproducibility. Students also learn how to communicate effectively.

DETAILED CONTENTS

1. Introduction, Layout, Facility of Lab (8 hrs)
Role of medical laboratory technology in total health care, principles of management, techniques of planning, physical facilities/equipment – layouts and design
2. Laboratory Organization (10 hrs)
Laboratory organization, operation, job description, evaluation, performance
3. Material Required (6 hrs)
Material management, procurement, financial resources, importing, inventory, control and analysis, inspection, storage etc
4. Quality Assurance (10 hrs)
Analytical control, Internal and external quality assurance in clinical laboratories, precision, accuracy, standard deviation as per national standards
5. Safety Precautions (5 hrs)
Safety measures in clinical laboratories (microbiology, haematology, biochemistry, histopathology and cytology, transfusion medicine), Disposal of Biomedical waste.
6. Human Relations and Motivation (4 hrs)
Inter-personal relations, inter and intradepartmental relations and their importance, concept and importance of motivation-drives and incentives; intrinsic and extrinsic motivation

7. Managing Psychological self (2 hrs)
- Stress
 - Emotions
 - Anxiety
8. Leadership (3 hrs)
- Concept, types, qualities of good leader
9. Medical Ethics and Code of Conduct (8 hrs)
- Ethics and code of conduct - legal aspects – confidentiality malpractice/negligence; legal implications, law suits, consumer protection and insurance for professional health hazards
10. Equipment – Care and Maintenance (5 hrs)
- Preventive maintenance and care of various laboratory equipment
11. Role of Computers in Lab (3 hrs)
- Storage and retrieval of laboratory data manually and with help of computers

INSTRUCTIONAL STRATEGY

Teachers should lay emphasis on concepts and principles while covering the subject contents. In the practical work, the students should be given opportunity to do practical work individually but under supervision.

Visits to hospital/medical colleges should be planned to demonstrate the processes. It is important to make use of models and audiovisual aids to show specific processes. Experts should be invited to deliver lecture on specific topics and share their experiences.

RECOMMENDED BOOKS

1. Medical Laboratory Technology by Praful B Godkar; Bhalani Publishing House, Mumbai (India)
2. Text Book of Medical Laboratory Technology by FJ Baker; Butterworths Heinmann Publishers, Oxford
3. Text Book of Medical Laboratory Technology by KL Mukherjee Vol I, II and III; Tata McGraw Hill Publishers, New Delhi
4. Medical Lab Technology by Ramnik Sood, Jay Pee Brothers, New Delhi
5. District Laboratory Practice in Tropical Countries by Monica Chesbrough, Churchill Livingstone.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time allotted (Hrs)	Marks Allotted (%)
1	8	12
2	10	16
3	6	8
4	10	16
5	5	8
6	4	6
7	2	4
8	3	5
9	8	12
10	5	8
11	3	5
Total	64	100

PERSONALITY DEVELOPMENT AWARENESS CAMP

This is to be organized at a stretch for two to three days during fifth or sixth semester. Extension Lectures by experts or teachers from the polytechnic will be delivered on the following broad topics. There will be no examination for this subject.

1. Communication Skills
2. Correspondence and job finding/applying/thanks and follow-up
3. Resume Writing
4. Interview Techniques: In-Person Interviews; Telephonic Interview' Panel interviews; Group interviews and Video Conferencing etc.
5. Presentation Techniques
6. Group Discussions Techniques
7. Aspects of Personality Development
8. Motivation
9. Leadership
10. Stress Management
11. Time Management
12. Interpersonal Relationship
13. Health and Hygiene