GURU KASHI UNIVERSITY

Master of Science in Medical Laboratory Technology

(Hematology and Blood Banking)

Session: 2024-25

Department of Paramedical Sciences

Graduate Attributes of Program

The Program M. Sc Medical Laboratory Technology (Hematology and Blood Banking) imparts to the students an intensive knowledge in the field of hematology and blood banking and create qualified and competent personnel to support the health care system.

Programme Learning Outcomes: After completion of this program, the learner will be able to

- Under take further advanced research of the highest quality that contributes to knowledge and exhibits authoritative international standing in their own specialization
- Make potentially innovative and important contributions to society, culture and the global community.
- Conduct original and rigorous research, contributing new knowledge and insights to their field of study.
- Formulate effective planning and time management to meet research deadlines and balance academic commitments.
- Explore new ideas and remain updated with the latest developments in their field.
- Think critically and creatively, exploring novel approaches to problem solving and research questions

Program Structure

Semester –I							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	MHB101	Basic Hematology	Core course	4	0	0	4
2	MHB102	Blood Banking	Core course	4	0	0	4
3	MHB111	Fundamentals of Research	Research Skills	2	0	0	2
4	MHB104	Basic Hematology Lab (Practical)	Skill Based	0	0	4	2
5	MHB105	Blood Banking Lab (Practical)	Skill Based	0	0	4	2
6	MHB110	Communication & Soft Skills	Compulsory Foundation	**2**	**0**	**0**	**2**
7	MHB112	Human Rights and Duties	Multidisciplinary	3	0	0	3
Discipline Elective-I (Any one of the following)							
8	MHB106	Clinical Biochemistry	Disciplinary Elective-I	3	0	0	3
9	MHB107	Immune-hematology					
			TOTAL	**18**	**0**	**8**	**22**

Semester -II							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	MHB201	Advance Hematology	Core Course	4	0	0	4
2	MHB202	Transfusion Medicine	Core Course	4	0	0	4
3	MHB211	Hematological Diseases	Core course	4	0	0	4
4	MHB204	Advance Hematology Lab (Practical)	Skill Based	0	0	4	2
5	MHB205	Transfusion Medicine Lab (Practical)	Skill Based	0	0	4	2
	MHB299	XXXX	MOOC	**0**	**0**	**0**	**2**
Value Added Course (For other disciplines also)							
6	MHB206	Quality Assurance and Patient Safety	VAC	2	0	0	2
Disciplinary Elective-II (Any one of the following)							
7	MHB207	Quality Control in Hematology	Disciplinary Elective-II	3	0	0	3
8	MHB208	Recent Advances in Blood Banking					
Disciplinary Elective-III (Any one of the following)							
9	MHB209	Clinical Microbiology	Disciplinary Elective-III	3	0	0	3
10	MHB210	Blood Banking and Human Genetics					
			TOTAL	**20**	**0**	**8**	**26**

Semester -III							
Sr. No.	**Course Code**	**Course Title**	**Type of course**	**L**	**T**	**P**	**Credits**
1	MHB301	Research Methodology	Compulsory foundation	2	0	0	2
2	MHB311	Clinical Research	Research Project	0	0	4	2
3	MHB312	Bioethics & Intellectual Property Right	Elective Foundation	2	0	0	2
4	MHB313	Transfusion Reaction and Complications	Core Course	4	0	0	4
5	MHB314	Transfusion Reaction and Complications Lab Practical	Skill Based	0	0	2	1
6	MHB315	Bioinformatics and Computational biology Lab	Skill Based	0	0	2	1
7	MHB399	XXXX	MOOC	0	0	0	2
8	MHB307	Innovation, creativity and Entrepreneurial mind set	Entrepreneurship skills	2	0	0	2
9	MHB308	Drug Abuse	VAC	2	0	0	2
10	MHB309	Blood Donation & Blood Components	Disciplinary Elective-IV	3	0	0	3
11	MHB310	Medical Lab Management					
12	XXXX	XXXX	IDC	2	0	0	2
			Total	**17**	**0**	**8**	**23**
Open Elective							
13	OEC072	First Aid	Open Elective	2	0	0	2
14	OEC016	Health care and Nutrition					

Semester-IV							
Sr. No.	**Course Code**	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
1	MHB401	Dissertation	Dissertation	0	0	0	20
2	MHB402	Skills & Professional Development	AEC	0	0	2	1
			Total	**0**	**0**	**2**	**21**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]

CA1- Surprise Test (Two best out of three) (10 Marks)
CA2- Assignment(s) (10 Marks)
CA3- Term paper/ Quiz/Presentation (05 Marks)

B. Attendance (05 Marks)
C. Mid Semester Test: (30 Marks)
D. End-Semester Exam: (40 Marks

Course Title: Basic Haematology

Course Code: MHB101

L	T	P	Cr.
4	0	0	4

Total Hours 60

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

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

Course Contents

UNIT-I **14 Hours**

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

UNIT-II **16 Hours**

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

UNIT-III **16 Hours**

Haemoglobinometery: Haemoglobinometery definition, Total Leucocyte count (TLC), Differentiate leucocyte count (DLC), Erythrocyte Sedimentation Rate (ESR), Packed cell volume/ Hematocrit

value, Red cell indices (RCL), Absolute Eosinophil count (ESR), Reticulocyte count, Platelet count, Preparation of blood films.

UNIT-IV **14 Hours**

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

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

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

Course Title: Blood Banking

Course Code: MHB102

L	T	P	Cr.
4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learners will be able to

1. Perform the Compatibility test in blood transfusion.
2. Demonstration about the collection of blood for cross matching from a blood bag.
3. Preparevarious fractions of blood for transfusion and therapeutic purposes
4. Understand bacterial cell and eukaryotic cell; parallelism between genes and chromosomes.

Course Contents

UNIT-I **Hours: 14**

Introduction to Blood Banking History and discovery of various blood group systems ABO blood group system Rh and other major blood group system Sources of error in blood grouping and their elimination.

UNIT-II **Hours: 14**

ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and reverse grouping Rh grouping, Compatibility test in blood transfusion, Collection of blood for cross matching from a blood bag, Major cross matching, Minor cross matching, Use of enzymes in blood bank specially Papain

UNIT-III **Hours: 16**

Brief introduction of blood substitute/artificial blood, Hemaphaeresis: pertaining to Leucocytes, platelets and plasma, Quality control in blood bank, Complications and hazards of blood transfusion, Laboratory investigations of transfusion reactions and mismatched blood transfusion, Precautions while procurement and storage of grouping antisera.

UNIT-IV **Hours: 16**

Various anticoagulants used to collect blood for transfusion purposes, Selection of donor and procedure for collection of blood from a healthy donor, Preparation of various fractions of blood for transfusion and therapeutic purposes such as: Packed red cells, washed red cells and FROZEN Red cells, Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets, Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate

Transactional modes

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

Suggested Readings

- *Lewis, S. M., Bain, B. J., Bates, I., &Dacie, J. V. (2001). Dacie and Lewis practical haematology. London: Churchill Livingstone*
- *Lawicki, S., Covin, R. and Powers, A., 2017. The Kidd (JK) Blood Group System. Transfusion Medicine Reviews, 31(3), pp.165-172.*

- *Lazarus, H. and Schmaier, A., 2012. Concise guide to hematology. Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.*
- *Overfield, J., Dawson, M. and Hamer, D., 2008. Transfusion science. Bloxham, Oxfordshire: Scion*

Course Title: Haematological Diseases

Course Code: MHB103

L	T	P	Cr.
4	0	0	4

Total Hours: 60

Learning Outcomes: After completion of this course, the learners will be able to

1. Understand the underline pathophysiology of hematological diseases, including the cellular and molecular mechanisms involved.
2. Recognize the signs and symptoms associated with various hematological disorders and differentiate them from other conditions
3. Learn to interpret hematological tests, blood smears, bone marrow aspirates, and imaging studies to arrive at a diagnosis.
4. Understand how to manage patients with hematological disorders, including monitoring, supportive care, and symptom management.

Course contents

Unit-I **14 Hours**

Investigation of patients with blood diseases. Anemia. Classification, Degrees of anemic state. Iron Metabolism. Iron deficiency anemia. Definition. Classification. Pathogenesis. Clinical features - major syndromes. Laboratory tests. Diagnostic criteria. Differential Diagnosis. Treatment. Prognosis. Anemia in Chronic Diseases.

Hypo-and aplastic anemias. Pathogenesis. Classification. Aplastic anemia. Definition. Incidence. Pathogenesis. Diagnostic criteria. Differential Diagnosis Treatment. Prognosis. Acquired haemolytic anemias. Immune, autoimmune and drug-induced immune haemolytic anemias.

Unit-II **16 Hours**

Malignant Diseases of the Blood and Hematopoietic organs. Major Pathogenetic Mechanisms of Neoplastic Growth. Classification of malignant diseases of the blood and hematopiestic organs. Acute leukemias. Mechanisms of neoplastic growth (oncogenesis). Classification of hematological malignancies. Acute myeloblastic leukemia. Classification. Risk Factors. Clinical manifestation. Diagnostic methods and diagnostic criteria. Differential diagnosis. Principles of treatment, treatment phases, therapeutic response. Prognosis. Acute lymphoblastic leukemia. Principal differences from myeloblastic leukemias. Classification. Clinical manifestiation. Diagnostic methods and diagnostic criteria. Differential diagnosis. Prognostic factors. Principles of treatment, treatment phases, therapeutic response. Prognosis

Unit-III **14 Hours**

Hemostasis. Bleeding diatheses. Mechanisms of hemostasis. Laboratory diagnostics, clotting assays. Congenital bleeding disorders (coagulopathies). Definition. Classification. Clinical Characteristics of haemorrhagic diathesis. Hemophilia-A and Hemophilia-B. Pathogenesis. Clinical manifestation.

Classification. Diagnostic criteria Prenatal diagnosis. Treatment. Prophylactic strategy. Treatment of Haemophilia with Inhibitors. Von Villebrand's disease. Definition Pathogenesis Clinic Classification Diagnostic criteria Treatment

Unit-IV **14 Hours**

Thrombocytopathies and thrombocytopenias. Classification. Thrombocytopathies Definition. Classification. Hemostasis laboarotory tests. Disseminated intravascular coagulation. Definition. Ethiopathogenesis. Phases. Clinical manifestation. Clinical forms. Diagnostic criteria. Differential diagnosis. Treatment Monitoring.

Suggested Readings

- *Text book of Medical Laboratory Technology by Paraful B. Godkar*
- *Medical laboratory Technology by KL Mukherjee Volume-I*
- *Practical Haematology by JB Dacie*
- *Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henary*
- *Atlas of Haematology (5th edition) by G.A. McDonald*
- *De Gruchy's clinical Haematology in medical practice*

Course Title: Basic Hematology (Practical)

Course Code: MHB104

L	T	P	Cr.
0	0	4	2

Total Hours 30

Learning Outcomes: After completion of this course, the learners will be able to

1. Analyze and interpret laboratory results, identify potential sources of error, troubleshoot technical issues, and propose appropriate solutions.
2. Maintain and monitor the quality of laboratory reagents, equipment, and procedures to ensure accurate and reliable results.
3. Determination of red blood cell count, hemoglobin concentration, hematocrit, white blood cell count, and platelet count.
4. Identify and describe normal and abnormal cell types, including differentiating between various types of white blood cells.

Course content

List of Practical's / Experiments: 30 Hours

1. Preparation of various anticoagulants: EDTA, Sodium Citrate, Oxalate with Fluoride
2. Collection of blood sample for various Lab Investigations
3. Demonstration of- Microscopes, Haemocytometers, Colorimeter, Spectrophotometer**,** Glass pipettes & Auto pipettes, Glassware
4. Haemoglobin (Hb) level: Measures the amount of haemoglobin, the protein responsible for carrying oxygen, in the blood.
5. Identification of Normal blood cells

Urine Analysis:

1. Physical and Chemical Examination of Urine
2. Routine biochemistry of Urine for: pH, Specific Gravity, Glucose, Ketones, Bilirubin, Albumin
3. Microscopic Examination of Urine

Transactional modes

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

Suggested Readings

- *Bain, Imelda, B. and John V. D. (2001). Practical Haematology. London: Churchill Livingstone*
- *Christopher, A. L. (1990) Clinical Haematology.*
- *John, B. H. (2001). Clinical Diagnosis &Management by Laboratory methods.*
- *McDonald, G.A. (1989). Atlas of haematology*
- *Godkar, P. B., &Godkar, D. P. (2003). Textbook of medical laboratory technology. Bhalani.*
- *Stephen, M. (2001). Clinical Haematology (Pathophysiological basis for clinical practice(3rd edition).*

Course Title: Blood Banking (Practical)

Course Code: MHB105

L	T	P	Cr.
0	0	4	2

Total Hours: 30

Learning Outcomes: After completion of this course, the learners will be able to

1. Analyze and interpret laboratory results, identify potential sources of error, troubleshoot technical issues, and propose appropriate solutions.
2. Maintain and monitor the quality of laboratory reagents, equipment, and procedures to ensure accurate and reliable results.
3. Determination of red blood cell count, hemoglobin concentration, hematocrit, white blood cell count, and platelet count.
4. Identify and describe normal and abnormal cell types, including differentiating between various types of white blood cells.

Course Content

List of Practical's

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
6. Direct or preliminary grouping
7. Indirect or proof grouping
8. Rh grouping and determination of Du in case of Rh negative
9. To perform Direct and Indirect Coomb's test
10. To perform cross matching
11. Major cross matching
12. Minor cross matching
13. Preparation of various fractions of blood.

Transactional modes

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

Suggested Readings

- *Bain, Imelda, B. and John V. D. (2001). Practical Haematology. London: Churchill Livingstone*
- *Christopher, A. L. (1990) Clinical Haematology.*
- *John, B. H. (2001). Clinical Diagnosis &Management by Laboratory methods.*
- *McDonald, G.A. (1989). Atlas of haematology*
- *Godkar, P. B., &Godkar, D. P. (2003). Textbook of medical laboratory technology. Bhalani.*
- *Stephen, M. (2001). Clinical Haematology (Pathophysiological basis for clinical practice(3rd edition).*

Course Title: Clinical Biochemistry

Course Code: MHB106

L	T	P	Cr.
3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learners will be able to

1 Demonstrate biomolecules, metabolism and inborn errors of metabolism.

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

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

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

Course Contents

UNIT-I **12 Hours**

Chemistry and metabolism of Carbohydrates- Definition, Aerobic & Anaerobic glycolysis, sequence of reactions in glycolysis, regulation in glycolysis, citric acid cycle, glycogenesis, glycogenolysis (sequence of reactions & regulation), Pentose-phosphate pathway (sequence of reactions & regulation), and extraction of energy from food sources.

UNIT-II **11 Hours**

Chemistry and metabolism of lipids- Definition, classification, Structures and roles of Fatty acids & Glycerols, beta oxidation of saturated fatty acids, oxidation of unsaturated fatty acids, oxidation of odd chain fatty acids, energy yield, ketone bodies.

UNIT-III **10 Hours**

Chemistry and metabolism of proteins- Definition -Important properties of proteins and amino acids - general metabolism of different amino acids – Amino acid breakdown (amino acid deamination, Urea cycle, metabolic breakdown of individual amino acids – glucogenic & ketogenic amino acids), amino acids as biosynthetic precursors (haem biosynthesis & degradation, biosynthesis of epinephrine, dopamine, seretonin, GABA, histamin, glutathione); biosynthesis of essential & non-essential amino acids

UNIT-IV **12 Hours**

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

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested readings

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

Course Title: Immune-hematology

Course Code: MHB107

L	T	P	Cr.
3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learners will be able to

- Describe about immune system, antigens, antibodies, immunoglobulin, monoclonal antibodies, and immunoglobulin and their structure and function.
- Develop skills in managing patients with immune hematologic disorders including assessing disease severity, monitoring treatment responses, and addressing complications.
- Acquire proficiency in laboratory techniques used to diagnose immune hematologic disorders, such as Direct Anti globulin Test (DAT) Indirect Anti globulin Test (IAT), Flow cytometry, and molecular diagnostics.
- Perform routine hematological tests and collection of specimens, reception and labeling and recording of laboratory investigations.

Course Contents

UNIT-I **10 Hours**

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

Antigens: Factors responsible for immunogenicity, immunogen, hapten and adjuvant, epitopes, heterophile antigen, super antigen. Antibodies: Structure and function of immunoglobulin, monoclonal antibodies, immunoglobulin genes, generation of antibody diversity, immunoglobulin super family

UNIT-II **12 Hours**

Blood Components and Functions: Blood composition and functions of different blood components, Haematopoiesis and erythropoiesis, Blood groups and typing, Blood Transfusion Basics: Transfusion reactions and their management, Blood Transfusion Practices: Pre-transfusion testing and patient identification, Blood product administration and monitoring

UNIT-III **14 Hours**

Blood donor selection and screening, Blood collection, processing, and storage, Transfusion-related infections and complications, Blood Group Systems and Typing: ABO and Rh blood grouping systems, other important blood group systems (e.g., Kell, Duffy, Kidd, etc.) Blood typing techniques and interpretation of results. Compatibility Testing and Cross matching: Principles of compatibility testing, Cross matching procedures (major and minor cross match), Quality control and quality assurance in blood transfusion services, Blood bank safety protocols and standard operating procedures, Regulatory and accreditation standards for blood banks.

UNIT-IV **11 Hours**

Immune Hematology: Autoimmune and allo-immune haemolytic anaemias, Hemolytic disease of the foetus and new-born (HDFN), Transfusion-related immune complications (e.g., transfusion-associated graft-versus-host disease, alloimmunization), Transfusion-Transmitted Infections: Screening and testing for infectious diseases in donated blood, Common transfusion-transmitted infections (e.g., HIV, hepatitis B and C, syphilis, malaria), Strategies for prevention and control of transfusion-transmitted infections

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *Brown, A., & Smith, H. (2014). Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.*
- *Brown, A., & Smith, H. (2014). Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.*
- *E Brown, A. (2001). Benson's Microbiological Applications Laboratory Manual in General Microbiology-Alfred E Brown.*
- *Tortora, G. J., Funke, B. R., Case, C. L., Weber, D., & Bair, W. (2004). Microbiology: an introduction (Vol. 9). San Francisco, CA: Benjamin Cummings.*
- *Parija, S. C. (2013). Textbook of Microbiology & Immunology-E-book. Elsevier Health Sciences.*
- *Murray, P. R., Rosenthal, K. S., & Pfaller, M. A. (2020). Medical microbiology E-book. Elsevier Health Sciences.*
- *Sachais, B. S., & Slichter, S. J. (2021). The scientific basis for platelet transfusion: Current practice and future prospects. CRC Press.*
- *Vamvakas, E. C., & Blajchman, M. A. (2008). Transfusion-related immunomodulation (TRIM): An update. Blood Reviews, 22(4), 203-217.*

Course Title: Blood donation and blood components

Course Code: MHB108

L	T	P	Cr.
3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learners will be able to

- Appreciating the importance of blood donation; recognizing the critical role of blood donation in health care, emergency situations, surgeries and treatment of various diseases
- Learning about the steps involved in blood donation including registration, medical screening, the actual donation and post donation care
- Identifying the different types of blood cells including RBS, WBCS and platelets.
- Understanding the significance of blood type compatibility in transfusions to prevent adverse reactions.

Course Content

UNIT-I **14 Hours**

Donor Motivation, Motivational Techniques, Social Marketing, Preparation of IEC Materials Donor recruitment & Retention: Types of blood donors, Donor selection, medical interview and medical examination, screening for haemoglobin estimation Managing rejected blood donors, technique for conversion of first time donor into regular voluntary donor, donor felicitation

UNIT-II **14 Hours**

Blood collection room equipment, their principles, and use, emergency medicines, Pre donation counseling, bleeding of the donor, post donation care, post donation counseling. Screening of blood

units for mandatory tests, discarding infected units, Blood Donation drive: Awareness programs prior to blood donation drive, Camp site, staff requirement, management of camp, transportation of blood units from camp site to blood bank Preservation of donated blood, blood preservation solutions, additive solutions

UNIT-III **17 Hours**

Apheresis procedures, Apheresis products, preparation of multiple products on cell separators, Maintenance of cell separator equipment Autologous blood donation Selection of blood bags for component preparation, preparation of red cell concentrate, Fresh Frozen plasma, platelet concentrate, cryoprecipitate, washed red cells, Frozen red cells Plasma Fractionation: Principles, manufacturing of different plasma derivatives Component Testing, Labeling,

transportation and storage of blood components. Preparation of leukoreduced blood products, Leukocyte filters, component extractors. Metabolic changes in blood components during storage, release of cytokine during storage

Transactional modes

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

Suggested Readings

- *Overfield, J., Dawson, M. and Hamer, D., 2008. Transfusion science. Bloxham, Oxfordshire: Scion*
- *Sachais, B. S., & Slichter, S. J. (2021). The scientific basis for platelet transfusion: Current practice and future prospects. CRC Press.*
- *Vamvakas, E. C., & Blajchman, M. A. (2008). Transfusion-related immunomodulation (TRIM): An update. Blood Reviews, 22(4), 203-217.*
- *Bishop, M. L., Fody, E. P., & Schoeff, L. E. (2013). Clinical chemistry: principles, techniques, and correlations. Lippincott Williams & Wilkins.*

Course Title: Medical Laboratory Management

Course Code: MHB109

L	T	P	Cr.
3	0	0	3

Total Hours 45

Course Learning Outcomes: After completion of this course, the learners will be able to

1. Understand the organizational structure and functions of a medical laboratory.
2. Apply quality management principles and tools to ensure accurate and reliable laboratory results.
3. Demonstrate knowledge of financial management techniques specific to medical laboratories.
4. Comply with relevant regulations, accreditation standards, and ethical considerations in laboratory management

Course Contents

UNIT-I **10 Hours**

Introduction to Medical Laboratory Management Definition and scope of medical laboratory management, Roles and responsibilities of a laboratory manager, Trends and challenges in laboratory management, Laboratory Organization and Workflow

UNIT-II **15 Hours**

Organizational structures in medical laboratories, Laboratory workflow and process optimization, Equipment and inventory management

Quality Management Systems, Introduction to quality management in laboratories, Quality control and assurance, Accreditation and regulatory requirements, Risk management and error prevention, Financial Management in Medical Laboratories

UNIT-III **10 Hours**

Budgeting and financial planning, Cost analysis and pricing of laboratory services, Reimbursement systems and insurance considerations, Revenue cycle management, Human Resource Management, Recruitment, training, and development of laboratory staff, Performance evaluation and staff motivation, Teamwork and effective communication

UNIT-IV **10 Hours**

Compliance with relevant laws and regulations (e.g., HIPAA), Ethical considerations in laboratory management, Data privacy and security

Strategic Planning and Continuous Improvement, developing a strategic plan for a medical laboratory, Monitoring and improving laboratory performance

Implementing change and innovation

Transactional modes

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

Suggested Readings

- *Harr, R. B. (2016). Medical Laboratory Management and Supervision: Operations, Review, and Study Guide (2nd ed.). American Society for Clinical Pathology Press.*
- *O'Connor, M. L., & Williams, A. (2019). Clinical Laboratory Management (2nd ed.). Elsevier.*
- *Garza, D., & Becan-McBride, K. (2015). The Laboratory Manager's Handbook (4th ed.). ASQ Quality Press.*
- *Vallero, D. A. (2017). Clinical Laboratory Management: A Guide for Clinical Laboratory Scientists. CRC Press.*
- *Mayo Clinic (Eds.). (2016). Mayo Clinic Medical Laboratory Science and Pathology Board Review (3rd ed.). Oxford University Press.*

2nd Semester

Course Title: Advance Hematology

Course Code: MHB201

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: After completion of this course, the learners will be able to

1 Identify and differentiate various pathological conditions based on laboratory findings

2 Interpret and analyze laboratory results, including hematological, biochemical, and immunological tests.

3 Understand the principles and techniques of clinical pathology for accurate diagnosis and monitoring of diseases.

4 Apply quality control measures and ensure safety in clinical laboratory practices.

Course Contents

Unit I **14 Hours**

Constituents of blood and bone marrow, Regulation of hematopoiesis. Anemia: classification and clinical features; clinical and lab. approach to diagnosis Pathology. Nutritional anemias: Iron deficiency anemia, Folic Acid/Vit B 12 deficiency anemia including pernicious anemia. Hemolytic Anemias: Classification and investigation.

Unit II **16 Hours**

Hereditary hemolytic anemias: Thalassemia, sickle cell anemia Hereditary hemolytic anemias: hereditary spherocytosis, G-6-PD deficiency Acquired hemolytic anemias, Hemolytic Anemias: Autoimmune, Alloimmune, Hemostatic disorders: Platelet deficiency; ITP, Drug induced, secondary k) Coagulopathies: Coagulation factor deficiency; hemophilia. Leukocytic disorders: Leukocytosis, leukopenia, Acute and chronic Leukemia: Classification, Diagnosis.

Unit III **14 Hours**

Blood transfusion: grouping and cross matching, untoward reactions, transmissible infections including HIV and hepatitis. Infectious diseases, new and emerging infectious

diseases, categories of infectious diseases in brief, Special techniques for diagnosing infections, Tuberculosis-etiology, pathogenesis and lab diagnosis, Leprosy – etiology, pathogenesis and lab diagnosis, HIV- epidemiology, pathogenesis and lab diagnosis.

Unit IV **16 Hours**

Classification and Laboratory diagnosis of Hemolytic anemia. Definition, classification and laboratory diagnosis of Leukemia. Chromosomal studies in various hematological disorders and their significance. Laboratory diagnosis of bleeding disorders with special emphasize to Hemophilia A, B & Von-Willebrand disease DIC. Platelet disorder (Qualitative and quantitative) Laboratory approach for investigating thrombosis. Using radioisotopes measurement of: Blood volume, Determination of Red cell volume and Plasma volume, Red cell life span, Platelet life span

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *Kumar, V., Abbas, A. K., & Aster, J. C. (2014). Robbins and Cotran pathologic basis of disease. Elsevier Health Sciences.*
- *Henry, J. B. (Ed.). (2011). Clinical diagnosis and management by laboratory methods. Saunders.*
- *Jaffe, E. S., Harris, N. L., Vardiman, J. W., & Campo, E. (Eds.). (2016). Hematopathology. Elsevier Health Sciences.*
- *McClatchey, K. D. (Ed.). (2018). Clinical laboratory medicine. Wolters Kluwer.*
- *Rodak, B. F., & Carr, J. H. (2019). Clinical hematology atlas. Elsevier Health Sciences.*
- *Bishop, M. L., Fody, E. P., & Schoeff, L. E. (2013). Clinical chemistry: principles, techniques, and correlations. Lippincott Williams & Wilkins.*
- *Text book of Medical Laboratory Technology by Paraful B. Godkar*
- *Medical laboratory Technology by KL Mukherjee Volume-I*
- *Practical Haematology by JB Dacie*
- *Clinical Diagnosis &Management by Laboratory methods (20th edition) by John Bernard Henary*
- *Atlas of Haematology (5th edition) by G.A. McDonald*
- *De Gruchy's clinical Haematology in medical practice*

Course Title: Transfusion Medicine

Course Code: MHB202

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: After completion of this course, the learners will be able to

1. Understand the basic concepts of blood banking and transfusion medicine.
2. Perform and interpret routine blood bank tests and procedures.
3. Identify blood groups, antibodies, and antigens involved in blood transfusion.
4. Demonstrate knowledge of blood component preparation and storage.

Course Contents

UNIT-I **15 Hours**

Introduction to Blood Banking, History and evolution of blood banking, Role and responsibilities of a blood bank technologist, Regulatory and ethical considerations in blood banking, Quality assurance and quality control in blood banking, Standard operating procedures (SOPs) and documentation, Blood bank safety measures and infection control.

UNIT-II **15 Hours**

Blood Collection and Processing, Blood collection techniques and anticoagulants, Blood component separation and processing methods, Donor screening and blood donor selection criteria, Transfusion guidelines and protocols, Documentation and record-keeping in blood transfusion

UNIT-III **15 Hours**

Blood Group Systems, ABO and Rh blood group systems, Other significant blood group systems (Kell, Duffy, etc.) Inheritance patterns and clinical significance of blood groups, Immunological and non-immunological adverse reactions, Blood bank organization and staffing.

UNIT-IV **15 Hours**

Blood Components and Storage, Preparation and storage of packed red blood cells (PRBCs), Platelet concentrates and cryoprecipitate preparation, Fresh frozen plasma (FFP) and other blood components, Haemolytic disease of the foetus and new-born (HDFN), Transfusion support in patients with autoimmune disorders

Transactional modes

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

Suggested Readings

- *Lewis, S. M., Bain, B. J., Bates, I., &Dacie, J. V. (2001). Dacie and Lewis practical haematology.London: Churchill Livingstone*
- *Lawicki, S., Covin, R. and Powers, A., 2017.The Kidd (JK) Blood Group System. Transfusion.Medicine Reviews, 31(3), pp.165-172.*
- *Lazarus, H. and Schmaier, A., 2012. Concise guide to hematology.Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.*
- *Overfield, J., Dawson, M. and Hamer, D., 2008. Transfusion science.Bloxham, Oxfordshire:Scion.*

Course Title: Transfusion Reactions and Complications

Course Code:MHB203

L	T	P	Cr.
4	0	0	4

Total Hours 60

Course Learning Outcomes: After completion of this course, the learners will be able to:

- Ability to identify signs and symptoms of different types of transfusion reactions like acute hemolytic reaction, febrile non-hemolytic reaction, allergic reaction etc.
- Knowledge of the immunological and non-immunological mechanisms that can lead to transfusion reactions.
- Understanding of proper techniques for administering blood and blood products.
- Knowledge of post-reaction assessments to monitor patient status and ensure resolution of the reaction.

Course Contents

Unit-I **16 Hours**

Blood donation, Motivating factors for donation Whole blood donation Vs apheresis donation Types: allogeneic, autologous, directed Donor questionnaire and interview: Eligibility and deferral criteria Donor reactions and their management Blood Component Prepration, Basic steps in component preparation & labeling Composition: volume, cellular, plasma and clotting factor content Storage conditions for components “Storage lesions” Quality control standards Specialized blood components – irradiated, volume reduced, CMV free, HLA matched.

Unit-II **14 Hours**

Pretransfusion testing Patient specimen labeling requirements Patient / component identification requirements ABO / Rh, Red cell antibody screen, Cross match Abbreviation of compatibility testing in emergency, Transfusion indications Red blood cells, Platelets, Plasma / cryoprecipitate, Granulocytes, Massive transfusion Metabolic complications Dilutional coagulopathy Switching ABO / Rh types, Massive transfusion Metabolic complications Dilutional coagulopathy Switching ABO / Rh types

Unit-III **16 Hours**

Transfusion reactions: Diagnosis, pathophysiology, Treatment, Prevention, Infectious complications: Bacterial, parasitic, viral, prions, Current risk & Prevention strategies, Adverse effects of transfusion, Recognition, testing, treatment, prevention strategies for hemolytic transfusion reaction, allergic anphylactoid reaction, Clotting factor disorders: Principle of hemostasis & coagulation, Lab tests of coagulation status, Selection and dosage of factor preparations, Management of patients with inhibitors,

Transfusion alternatives: Synthetic and natural volume expanders, Hemoglobin solution, Perfluorochemicals, Fibrin glue, Hemostatic agent

Unit-IV **14 Hours**

Transfusion therapy in special patients, Hematology / Oncology, Pediatric / neonatal, Obstetric including intra uterine, Cardiac surgery with CPB, Burn patients & Trauma patients, Transplantation: Stem cell / Bone marrow, Liver, Kidney, Hemolytic disease of newborn, Pathophysiology, Causative blood group antibodies, Treatment & Prophylaxis, Hemoglobinopathy, Classification, Pathophysiology, Diagnosis &Transfusion therapy

Transaction Modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *Blood transfusion in clinical medicine, Ed. Pl mollison, 8th edition, Blackwell Sci.Pub. Oxford.*
- *Transfusion Medicine, Ed. WH churchill, SR Kurtz, Blackwell Sci, Pub, Oxford,1988*
- *Clinical Practice of Transfusion Medicine, Ed. L Petz, Swisher, 2nd edition, Curchill Livingstone, New York, 1989.*
- *Blood transfusion therapy: A problem oriented approach, Ed. JAF napier, John, Willey & sons, Chichester, 1987*

Course Title: Transfusion Reactions and Complications Practical

Course Code:MHB203

L	T	P	Cr.
4	0	0	4

Total Hours 60

- **Blood Typing and Crossmatching**
- Hemolytic Transfusion Reactions.

- Febrile Non-Hemolytic Transfusion Reactions
- Transfusion-Associated Circulatory Overload (TACO)
- Transfusion-Related Acute Lung Injury (TRALI)
- Bacterial Contamination
- **Post-Transfusion Purpura (PTP)**

Course Title: Advance Hematology (Practical)

Course Code: MHB204

L	T	P	Cr.
0	0	4	2

Total Hours 30

Course Learning Outcomes: After completion of this course, the learners will be able to:

1. Ability to prepare high quality blood smears for microscopic examination
2. Skill in accurately identifying and differentiating between various types of blood cells, including RBCS, WBCS, and platelets
3. Recognize normal and abnormal test results and correlate these data with appropriate pathologic conditions to accurately advise health care providers.
4. Adapt laboratory techniques and procedures when errors and discrepancies in results are obtained to effect resolution in a professional and timely manner.

List of Practical's / Experiments **30 Hours**

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.
13. To demonstrate BT, CT, PT, INR, APTT, TT.
14. To demonstrate Mixing experiments.
15. Tests of D-Dimers and Assay of Coagulation factors.

Transactional modes

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

Suggested Readings

- *Wintrobe clinical haematology Vol- I - 10th edition*
- *Windtrobe clinical haematology Vol- II -10th edition*
- *Lynch's Medical Lab - Technology Latest edition*
- *Clinical Diagnosis & Management - Todd & Sanford 19th edition 1996*
- *Medical Laboratory Technology by Sood 5th edition, Jaypee Brothers 1999*
- *Clinical Haematology in Medical Practice - G.C. Degruchy - 5th edition*

Course Title: Transfusion Medicine (Practical)

Course Code: MHB205

L	T	P	Cr.
0	0	4	2

Total Hours 30

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

5. Apply advanced blood bank and blood transfusion knowledge to make appropriate and effective on-the-job professional decisions.
6. Perform and interpret commonly utilized procedures in the blood bank laboratory.
7. Recognize normal and abnormal test results and correlate these data with appropriate pathologic conditions to accurately advise health care providers.
8. Adapt immunohematology laboratory techniques and procedures when errors and discrepancies in results are obtained to effect resolution in a professional and timely manner.

List of Practical's / Experiments **30 Hours**

1. Safety precautions in the blood bank laboratory
2. Identification and labeling of blood samples
3. Aseptic techniques in blood collection
4. Blood group typing techniques (ABO and Rh systems), cross matching techniques
5. Blood transfusion reactions and their management
6. Blood Component Preparation and Storage
7. Preparation of packed red blood cells (PRBCs)
8. Preparation of fresh frozen plasma (FFP)
9. Blood component storage and transportation
10. Quality control and quality assurance in blood component preparation
11. Donor selection criteria
12. Venipuncture techniques for blood collection, Donor adverse reactions and their management
13. Screening tests for transfusion-transmitted infections (HIV, Hepatitis B and C, syphilis, etc.)

Transactional modes

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

Suggested Readings

- *Lewis, S. M., Bain, B. J., Bates, I., &Dacie, J. V. (2001). Dacie and Lewis practical haematology.London: Churchill Livingstone*
- *Lawicki, S., Covin, R. and Powers, A., 2017.The Kidd (JK) Blood Group System. Transfusion.Medicine Reviews, 31(3), pp.165-172.*
- *Lazarus, H. and Schmaier, A., 2012. Concise guide to hematology.Chichester, West Sussex, UK: Wiley-Blackwell, pp.77-81.*
- *Overfield, J., Dawson, M. and Hamer, D., 2008. Transfusion science.Bloxham, Oxfordshire:Scion.*

Course Title: Quality Assurance And Patient Safety

Course Code: MHB206

L	T	P	Cr.
2	0	0	2

Total Hours 30

Learning Outcomes: After completion of this course, the learners will be able to

1. They will get the knowledge about the health care discipline that emerged with the evolving complexity in health care systems and the resulting rise of patient harm in health care facilities.
2. Students will get to know the ways to prevent and reduce risks, errors and harm that occur to patients during provision of health care.
3. This subject is continuous improvement based on learning from errors and adverse events.
4. Important role in Quality improvement approaches, standards and norms.

Course Contents

UNIT-I **8 Hours**

Quality assurance and Management Introduction, Quality improvement approaches, standards and norms, quality improvement tools, introduction to NABH guidelines. Basic of Emergency care and Life support skills Basic life support (BLS) following cardiac arrest, recognition of sudden cardiac arrest and activation of emergency response system, early cardiopulmonary resuscitation (CPR) and rapid defibrillation with an automated external defibrillator (AED)

UNIT-II **6 Hours**

Basic emergency care First aid, choking, rescue breathing methods, ventilation including use of bag valve masters (BVMs) Biomedical Waste Management Definition, waste minimization.

UNIT-III **8 Hours**

BMW-segregation, collection, transportation, treatment and disposal (Including color coding), Liquid BMW, Radioactive waste, metals/chemicals/drug waste, BMW management and methods of disinfection, use of Personal protective equipment (PPE), Infection Prevention and Control, Sterilization, Disinfection, Effective hand hygiene, use of PPE,

UNIT-IV **8 Hours**

Prevention and control of common health care associated infections, Guidelines (NABH) and JCI for hospital infection control. Disaster preparedness and management Fundamentals of emergency management

Transactional modes

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

Suggested Readings

- *Vincent, C. (2011). Patient safety. John Wiley & Sons.*
- *Hall, L. M. (Ed.). (2005). Quality work environments for nurse and patient safety. Jones & Bartlett Learning.*
- *Sandars, J., & Cook, G. (Eds.). (2009). ABC of patient safety (Vol. 72). John Wiley & Sons.*
- *Carayon, P. (2006). Handbook of human factors and ergonomics in health care and patient safety. CRC press.*

Course Title: Quality Control in Hematology

Course Code: MHB207

L	T	P	Cr.
3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learners will be able to

1. Knowledge of the accrediting bodies and agencies like Clinical Laboratory Improvement Amendments – CLIA and College of American Pathologists - CAP that set the standards for hematology laboratories.

2. Familiarity with the various hematological parameters measured in a complete blood count (CBC) and their clinical significance (e.g., red blood cell count, white blood cell count, hemoglobin, hematocrit, platelet count, etc.)

3. Ability to operate and maintain hematology analyzers and associated equipment to ensure proper functioning and accurate results

4. Knowledge of quality control materials (e.g., commercial controls, in-house controls) and the procedures for using them to monitor the accuracy and precision of laboratory tests.

Course Contents

UNIT-I 15 Hours

Quality control of blood grouping reagents, QC of anti-human globulin reagent, bovine albumin, normal saline, quality control of blood bags, quality control of different blood banks components, sterility test on computer

UNIT-II 15 Hours

Calibration, validation and maintenance of blood bank equipment, QC of blood bank techniques, internal and external QC, Organization of blood bank services, Blood Bank premises and infrastructure, regional blood transfusion Centre and blood storage Centre, blood bank management system.

UNIT-III 15 Hours

Regulations for blood bank operation: Drugs and cosmetics Law, National blood policy, standards in Blood Banking, licensing procedures. Recruitment and training of blood bank personnel, Proficiency testing. Blood Bank Accreditation, Automation in Blood Banking, Nucleic Acid Testing, Apheresis , Stem Cells.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *Hematology: Basic Principles and Practice" by Ronald Hoffman, Edward J. Benz, et al.*
- *"Rodak's Hematology: Clinical Principles and Applications" by Elaine Keohane, Larry Smith, et al.*
- *Hematology: Clinical Principles and Applications" by Bernadette F. Rodak and George A. Fritsma –*
- *Hemostasis and Thrombosis: Basic Principles and Clinical Practice" by Robert W. Colman, et al.*
- *"Quality Management in the Medical Laboratory: A Case Study Approach" by Linda M. Sandhaus*

Course Title: Recent Advances in Blood Banking

Course Code: MHB208

L	T	P	Cr.
3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learners will be able to

1. Familiarity with modern techniques like molecular typing and extended antigen matching, which enhance the precision of blood compatibility testing.

2. Understanding the principles and benefits of pathogen reduction methods, which enhance the safety of blood components.

3.Awareness of the pivotal role blood banks play in disaster management, including stockpile management, rapid deployment, and response coordination.

4. Understanding the ethical dilemmas and considerations surrounding issues like patient autonomy, informed consent, and resource allocation

Course Contents

Unit-I **15 Hours**

Automation and Computerization in blood bank services, Automated blood grouping & processing Automation in TTI testing Instrumentation & use of bar codes Use of computers in blood banking including Implementation of Blood Establishment Computer Software (BECS).

Unit-II **15 Hours**

Recent Advances in Blood Banking Latest trends in blood banking- Donor screening, retention, Blood collections, components etc. Recent advances in Automation of Blood Banking. Recent advances in apheresis procedures Nucleic Acid Testing. Stem Cells & Cord stem cell banking. Artificial blood

Unit-III **15 Hours**

Stem cell Preparation and Banking Stem cell- Cord blood, Peripheral blood Hematopoietic stem cell Stem cell banking and application. Procedures of collection of stem cell and calculation of stem cell collected, Quality control of products, Cryopreservation, maintenance, QC and thawing procedures in stem cell banking, Regenerative medicine. Ethical guidelines Concept of Bio banking 30 157 P

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Books Suggested

- *Transfusion Medicine and Hemostasis: Clinical and Laboratory Aspects" by Christopher D. Hillyer, Beth H. Shaz, et al.*
- *"Immunohematology and Transfusion Medicine: A Case Study Approach" by Connie M. Westhoff*
- *"Blood Transfusion Therapy: A Physician's Handbook" by Richard Kaufman, Edward L. Snyder, et al.*
- *Patient Blood Management: From Principles to Practice" by Aryeh Shander, Jean-Francois Hardy, et al.*
- *Blood Banking and Transfusion Medicine: Basic Principles and Practice" by Christopher D. Hillyer, et al*

Course Title: Clinical Microbiology

Course Code:MHB209

L	T	P	Cr.
3	0	0	3

Total Hours: 45

Learning Outcomes: After completion of this course, the learners will be able to

1. Recognition and description of different types of microorganisms (bacteria, fungi, viruses, parasites) and their cellular structures.
2. Proficiency in various microbiological techniques like staining, culturing, biochemical testing, and molecular methods for the isolation and identification of microorganisms.
3. Knowledge of infection control protocols to prevent the spread of infectious agents within healthcare settings.
4. Understanding the modes of transmission and epidemiology of infectious diseases to implement effective control measures.

Course Contents

Unit-I **15 Hours**

History of microbiology – classification of microorganism – Prokaryotes and Eukaryotes Morphology of bacteria – size, shape and arrangement of bacterial cell – cell wall, cytoplasmic membrane, flagella, fimbriae and pili, cytoplasmic matrix, nucleoid, cytoplasmic inclusions. Bacteria – Bacterial growth curve, growth requirements. Stains –simple stains, negative stain, differential stains and special stains. Sterilization and disinfection – Definition, physical agents – (sunlight, Drying, Dry heat, Moist heat, filtration, Radiation, Ultrasonic and sonic vibration) Chemical- (Alcohols, Aldehydes, Dyes, Halogens, Phenols, Gases) Culture methods (streak culture, Pour plate culture, Stab culture, anaerobic culture methods), colony count

Unit-II **15 Hours**

Identification of bacteria sero-typing and sub-typing, phage typing, Bacterial genetics- methods of gene transfer – Transformation-mechanism, natural and artificial, Transduction-mechanism, generalized and specialized transduction, lysogenic conversion, Conjugation-Properties of F-plasmid, HFr strains, col factor, Mechanism, Antibacterial antibiotics and their mode of action, Normal bacterial flora of human body, Automation in microbiology, Quality control in clinical microbiology laboratory.

Unit-III **15 Hours**

Sterilization and disinfection: Introduction, types, mode of action and application of sterilization by physical and chemical method, Testing for the potency of disinfectants including Minimum inhibitory concentration test, Rideal-Walker test, Chick-Martin, and Garrod test, Capacity use dilution test, Stability test, In-use test and test for disinfecting action on surfaces. Collection, transportation, preservation, storage, and processing of clinical specimens for aerobic and anaerobic culture, Methods of anaerobiosis: Displacement of oxygen, Absorption of oxygen, Displacement and combustion of oxygen, Biological method, and incorporating reducing agents in culture media.

Transaction Modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *Textbook of Diagnostic Microbiology, Connie R. Mahon MS*
- *Koneman's Color Atlas and Textbook of Diagnostic Microbiology, Gary W. Procop*
- *Jawetz Melnick & Adelbergs Medical Microbiology, Stefan Riedel, Stephen Morse, Timothy Mietzner, Steve Miller*
- *Medical Microbiology, Patrick R. Murray Ph.D., Ken S. Rosenthal Ph.D., Michael A. Pfaller MD*
- *Brock Biology of Microorganisms, Michael Madigan, Kelly Bender, Daniel Buckley, W. Sattley), David Sta*

Course Title: Blood Banking and Human Genetics

Course Code: MHB210

L	T	P	Cr.
3	0	0	3

Total Hours 45

Learning Outcomes: After completion of this course, the learners will be able to

1. Proficiency in various blood collection methods, including venipuncture and donor screening procedures
2. Skill in performing ABO and Rh blood typing, cross-matching, and antibody screening to ensure safe transfusions.
3. Recognition and interpretation of chromosomal abnormalities and their clinical implications.
4. Ability to provide information and support to individuals and families affected by genetic disorders.

Course Contents

UNIT I **15 Hours**

Introduction to Blood Banking, History and discovery of various blood group systems, ABO blood group system, Rh and other major blood group system, Sources of error in blood grouping and their elimination, ABO grouping: Forward and reverse grouping. Causes of discrimination between forward and reverse grouping, Rh grouping. Compatibility test in blood transfusion, Collection of blood for cross matching from a blood bag, Major cross matching, Minor cross matching, Use of enzymes in blood bank specially Papain.

UNIT II **15 Hours**

Complications and hazards of blood transfusion, Laboratory investigations of transfusion reactions and mismatched blood transfusion, Precautions while procurement and storage of grouping antisera. Various anticoagulants used to collect blood for transfusion purposes, Selection of donor and procedure for collection of blood from a healthy donor. Preparation of various fractions of blood for transfusion and therapeutic purposes such as: Packed red cells, washed red cells and FROZEN Red cells, Platelet Rich Plasma (PRP), Platelet concentrate and frozen platelets, Fresh plasma (FP), Fresh Frozen Plasma (FFP) and cryoprecipitate, Brief introduction of blood substitute/artificial blood, Haemopheresis, pertaining to Leucocytes, platelets and plasma, Quality control in blood bank.

UNIT III **15 Hours**

Continuity of life-heredity, variation, Mendel's laws of inheritance, Chromosomal basis of inheritance; other patterns of inheritance-incomplete dominance, multi parallelism, quantitative inheritance, Chromosomes - bacterial cell and eukaryotic cell; parallelism between genes and chromosomes; genome, linkage and crossing over; gene mapping; recombination, Molecular genetics: DNA as a genetic material- its structure and replication; structure of RNA and its role in protein synthesis, Vectors, plasmids, Human Genetics, Microbial genetics.

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested readings

- *Technical Manual" by AABB, formerly known as the American Association of Blood Banks.*
- *Modern Blood Banking & Transfusion Practices by Denise M. Harmening*
- *Immunohematology: Principles and Practice by Eva D. Quinley*
- *Introduction to Genetic Analysis by Anthony J.F. Griffiths, Susan R. Wessler, Sean B. Carroll, and John Doebley*
- *Medical Genetics by Lynn B. Jorde, John C. Carey, and Michael J. Bamshad*
- *Genetics: Analysis and Principles by Robert J. Brooker*

Semester 3rd

Course Title: Research Methodology

Course Code: MHB301

L	T	P	Cr.
4	0	0	4

Total Hours: 60

Course Learning Outcomes: After successful completion of this course, the learners will be able to:

1. Prioritize the needs of research in the clinical field of Radiology.
2. Choose the appropriate research design and develop appropriate research hypothesis for a research project.
3. Describe the appropriate statistical methods required for a particular research design
4. Develop the ability to apply the methods while working on a research project work

Course Contents

UNIT I **15 Hours**

Research: its concept, nature, scope, need and Objectives of Research, Research types, Research methodology, Research process – Flow chart, description of various steps, Selection of research problem.

UNIT-II **15 Hours**

Research Design: Meaning, Objectives and Strategies of research, different research designs, important experimental designs, Methods of Data Collection and Presentation: Types of data collection and classification, Observation method, Interview Method, Collection of data through Question-Answernaires, Schedules, data analysis and interpretation, editing, coding, content analysis and tabulation.

UNIT-III **15 Hours**

Sampling Methods: Different methods of Sampling : Probability Sampling methods , Random Sampling, Systematic Sampling, Stratified Sampling, Cluster Sampling and Multistage Sampling. Non probability Sampling methods, Sample size.

UNIT-IV **15 Hours**

Report writing and Presentation: Types of reports, Report Format – Cover page, Introductory page, Text, Bibliography, Appendices, Typing instructions, Oral Presentation

Transactional modes

Video based teaching, Collaborative teaching, Case based teaching, Question-Answer,

Suggested Readings

- *Panneerselvam, R, 'Research Methodology', PHI, New Delhi.*
- *Cooper, D.R.,Schindler,P.S., 'Business Research Methods,' Tata McGraw Hill Gupta S P,' Statistical Methods', Sultan Chand & Sons, Delhi Ronald E Walpole, 'Probability and Statistics for Engineers and Scientists'*
- *(International Edition) , Pearson Education. Geode, Millian J. & Paul K. Hatl, "Methods in Research", McGraw Hills, New Delhi.*
- *Kothari C.R., "Research Methodology", New Age Publisher Nargundkar R, Marketing Research, Tata McGraw Hill, New Delhi, 2002. Sekran, Uma, "Business Research Method", Miley Education, Singapore.*
- *https://www.academia.edu/*
- *https://www.studeersnel.nl*
- *https://www.scribd.com*

Course Title: Research Proposal

Course Code: MHB302

L	T	P	Cr.
2	0	4	4

Total Hours: 60

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

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

Course Contents

UNIT I **10 Hours**

Research Methodology Introduction to research methods identifying research problem Ethical issues in research design

UNIT II **15 Hours**

Data Collection Experimental and non-experimental research designs Sampling methods, data collection, observation methods Interview method, Question-Answeraries' and schedules construction

UNIT III **15 Hours**

Research Frame Work Ethical issues in research Principles and concepts in research ethics-confidentiality and privacy informed consent writing research proposals Development of conceptual framework in research

UNIT-IV **20 Hours**

Rationale Basic principles of research and methods applied to draw inferences from the research findings. Measures of Dispersion, Skewness and kurtosis, Sampling, Sample size determination, Introduction and method of collecting and presenting statistical data. Calculation and interpretation of various measures like mean, median, standard deviations, Skewness and Kurtosis, Probability distribution, Correlation and regression Significance tests and confidence intervals

List of Experiment/Practical

- Understanding the purpose and importance of a research proposal. Identifying research topics and formulating research Question-Answers
- Reviewing relevant literature and conducting a literature search, Ethical considerations in research proposal development
- Research Design and Methodology, selecting appropriate research designs (quantitative, qualitative, mixed methods)
- Sampling techniques and sample size determination, Data collection methods (surveys, interviews, observations, experiments), Instrument development and validation
- Data analysis techniques and statistical considerations
- Components of a Research Proposal, Title and abstract writing, Introduction and background section
- Research objectives and hypotheses, Methodology and study design, Data analysis plan and statistical considerations, Timeline and budget development
- Refining and Presenting the Research Proposal, Peer review and feedback process
- Revision and refinement of the research proposal, Oral presentation skills for research proposals
- Finalizing the research proposal and preparing it for submission, Funding opportunities and grant writing basics,
- Ethical Considerations and Institutional Review Boards (IRBs)
- Understanding ethical guidelines for research involving human subjects
- Writing an IRB application and addressing ethical concerns
- Presenting the research proposal to an audience and defending its merits
- Incorporating feedback and finalizing the research proposal

Transaction Mode-

Video based teaching, collaborative teaching, case based teaching, Question-Answer

Suggested Readings

- *Kothari, Chakravanti Rajagopalachari. Research methodology: Methods and techniques. New Age International, 2004.*
- *Mahajan, B. K., &Lal, S. (1999). Methods in biostatistics for medical students and research workers.Indian Journal of Community Medicine, 24(3), 140.*
- *Spiegel, M. R., Schiller, J. J., &Srinivasan, R. A. (2013).Schaum's outline of probability and statistics. McGraw-Hill Education.*

Course Title: Ethics & IPR

Course Code: MHB303

L	T	P	Cr.
2	0	0	2

Total Hours: 30

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

1. Explain different kind of ethics and values.
2. Apply professional ethics in business.
3. Explain the role of IPRs in professional life.
4. Elucidate the importance of patents and copyrights

Course Contents

UNIT I **07 Hours**

Ethics: definition, moral philosophy, nature of moral judgments and reactions, scope, Ethics with respect to science and research, Intellectual honesty and research integrity Scientific misconducts:

UNIT II **08 Hours**

Falsification, Fabrication, and Plagiarism (FFP) Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and Misrepresentation of data, Publication ethics: definition, introduction and importance.

UNIT-III **08 Hours**

Introduction to Intellectual Property rights: Concept & theories, Kinds of intellectual Property Rights, Advantages & Disadvantages of IPR, Development of IPR in India, Role & Liabilities of IPRs in India.

UNIT-IV **07 Hours**

Rights of trademark-kind of signs used as trademark-types, purpose &
Functions of a trademark, trademark protection, trademark registration, selecting and evaluating trade mark, trade mark registration process.

Transaction Mode-

Video based teaching, collaborative teaching, case based teaching, Question-Answer

Suggested Readings

- *"Ethics: Theory and Practice" by Jacques P. Thiroux and Keith W. Krasemann*
- *"Practical Ethics" by Peter Singer*
- *"Understanding Intellectual Property Law" by Donald S. Chisum, Tyler T. Ochoa, and Shubha Ghosh.*
- *"Intellectual Property: Patents, Trademarks, and Copyrights" by Richard Stim*

Course Title: Proficiency in Teaching

Course Code: MHB304

L	T	P	Cr.
0	0	4	2

Total Hours: 60

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

1. Design and develop learner-centered instructional plans and learning outcomes.
2. Apply innovative teaching strategies and technologies to engage learners.
3. Explore different assessment methods to evaluate student learning.
4. Reflect on teaching experiences and continuously improve teaching practices.
5. Develop effective communication and classroom management skills.

Course Content

UNIT I **15 Hours**

Overview of the course and its objectives - Theories of learning and their implications for teaching - Understanding the role of the teacher and student in the learning process -Writing clear and measurable learning outcomes - Meaning Nature, definition, scope and importance Pedagogy, Andragogy and Heutagogy – Skills based approach to teaching (Teaching skills), Micro-teaching, Macro teaching. Methods and approaches of teaching - CAM, Structure function approach, Synthetic and Analytic approach, Jurisprudential enquiry model

UNIT II **15 Hours**

Understanding the diverse needs and backgrounds of learners - Creating an inclusive and supportive learning environment - Facilitating active learning and student engagement strategies Lectures, discussions, and demonstrations - Group work, collaborative learning, and cooperative learning - Problem-based learning, case studies, and simulations

UNIT III **15 Hours**

Integrating technology tools into instruction – Online, blended learning, flipped learning and M-learning approaches - Using educational software and platforms effectively Formative and summative assessment methods – Difference between Assessment, Evaluation and Measurement, E-assessment tools

UNIT IV **15 Hours**

The importance of reflective practice in teaching - Self-assessment and evaluation of teaching effectiveness – Need of Professional development - Teaching in multicultural and international classrooms - Culturally responsive teaching practices Meaning, Definition of teaching model, Assumptions, Importance, Role and type of teaching models. Historical teaching model, Philosophical model of teaching

Transaction Mode

Discussions, Case Studies, Microteaching, Classroom Observations, Peer Teaching: Video Analysis, Role-Playing, Teaching Demonstrations, Classroom Simulations, Reflective Journals/Blogs, Teaching Portfolios and Technology Integration

Suggested Readings

- *Das, R.C. (1993): Educational Technology – A Basic Text, Sterling Publishers Pvt. Ltd. Evaut, M. The International Encyclopaedia of Educational Technology.*
- *Graeme, K. (1969): Blackboard to Computers: A Guide to Educational Aids, London, Ward Lock. Haas, K.B. and Packer, H.Q. (1990): Preparation and Use of Audio Visual Aids, 3rd Edition, Prentice Hall, Inc Haseen Taj (2006):modern Educational Technology,Agra : H.P Bhargava Book House.*
- *Kumar, K.L. (2008): Educational Technology, New Age International Pvt. Ltd. Publishers, New Delhi (Second Revised Edition).*
- *Mukhopadhyay, M. (1990): Educational Technology – Year Book 1988, All India Association for Educational Technology, New Delhi.*
- *Bruce R Joyce and Marsha Weil, Models of Teaching, Prentice Hall of India Pvt Ltd, 1985. Gage N L , Hand book of Research on Teaching, Rand Mc Naly and Co., Chicago, 1968.*
- *Sharma R A, Technology of Teaching, International Publishing House, Meerut, 1988. Siddiqui M S., and Khan M S., Models of Teaching – Theory and Research, Manas Publication, New Delhi, 1991*

Course Title: Service Learning

Course Code: MHB305

L	T	P	Cr.
0	0	4	2

Total Hours 60

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

1. Perform Specimen Collection and Handling: Students will demonstrate the ability to collect, handle, and process various types of biological specimens following proper procedures and protocols.
2. Conduct Laboratory Tests: Students will be able to perform a wide range of laboratory tests, including hematology, clinical chemistry, microbiology, immunology, and blood banking, utilizing appropriate techniques, equipment, and quality control measures.
3. Analyze and Interpret Laboratory Results: Students will develop the skills to analyze and interpret laboratory test results accurately, recognizing normal and abnormal values, and identifying potential errors or discrepancies.
4. Apply Quality Assurance and Quality Control: Students will understand and apply quality assurance and quality control practices to ensure the accuracy, reliability, and validity of laboratory test results, including proficiency testing and equipment calibration.

Course Title: Computer Lab

Course Code: MHB306

L	T	P	Cr.
0	0	4	2

Total Hours: 60

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

1. Understand the concepts of computer system, Windows operating system, Internet, various storage devices and computer Networks, e-waste
2. Analyze various components and Input output devices used in a computer system.
3. Utilize various applications and software's used
4. Creating and manipulating presentation, views, and formatting and enhancing text, and slide with graphs

Course Contents

UNIT I **05 Hours**

Generating Charts/Graphs in Microsoft Excel, Power Point Presentation, Creating a new document with templates & Wizard, Word basics, Thesis Writing Formats & scientific editing tools. Style Formats (MLA & APA)

UNIT II **05 Hours**

Using Words Drawing Features, Inserting Tables – (Adding, deleting, modifying rows and columns - merging & splitting cells), Using formulas in tables, Converting text to table and vice-versa, Mail Merge tool. Managing Workbooks, Working with Worksheets.

UNIT III **10 Hours**

Introduction of Windows: History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resize minimizing and maximizing, etc.). Introduction to MS- Word: 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.

UNIT IV **10 Hours**

Introduction to Excel: introduction, about worksheet, entering information, saving. Introduction of Operating System: introduction, operating system concepts, types of operating system. Computer Networks: introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.

Transaction Mode

Video based teaching, collaborative teaching, case based teaching, Question-Answer

Suggested Readings

- *Leon & Leon, "Introduction to Computers", Vikas Publishing House, New Delhi Saxena S., "MS Office Xp for Everyone", Vikas Publishing House, New Delhi, 2007 June Jamrich Parsons, "Computer Concepts", Thomson Learning, 7th Edition, Bombay*
- *White, "Data Communications & Computer Network", Thomson Learning, Bombay Comer, "Computer networks and Internet", Pearson Education, 4eRajaraman, V., &Radhakrishnan, T. (2006).*
- *Digital Logic and Computer Organization. PHI Learning Pvt. Ltd..Mehdi, M. M. (2015). Information Technology for Management by. FIIBBusiness Review, 4(1), 46-47.Ram, B. (2000).*
- *Computer fundamentals: architecture and organization. New Age International.Basandara, S. K. (2017).Computers Today,,Galgotia publication PvtLtd.*
- *A first course in computers: Based on Windows Xp& Office. Vikas Publishing House Pvt Ltd.*
- *Sinha P.K. and Sinha, P. (2007) Computer Fundamentals, BPB Publications. Bangia, R. (2008). Computer Fundamentals and Information Technology. Firewall Media.*
- *https://www.researchgate.nethttps://www.youtube.com/playlist?list=PLWPirh4EWFpF_2T13UeEgZWZHc8nHBuXp*

Course Title: XXXX (MOOC)

Course Code: MHB399

L	T	P	Cr.
4	0	0	4

Total Hours: 60

Semester 4th

Course Title: Training/Internship Report

Course Code: MHB401

L	T	P	Cr.
0	0	0	20

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

1. Prepare and maintain Operation Theatre as well as patients before surgery.
2. Maintain a sterile field and theatre equipment and follow infection control policies.
3. Manage hazardous waste and follow biomedical waste disposal protocols.
4. Demonstrate skills and knowledge to assist anesthetist in handling emergencies.

Course Contents

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