GURU KASHI UNIVERSITY

Masters of Science in (Medical Laboratory Technology) Hematology and Blood Banking

PG Curriculum (Appendix-III)

Session: 2025-26

Faculty of Health & Allied Sciences

Graduate Attributes of the Programme: -Masters of Science in (Medical Laboratory Technology) Hematology and Blood Banking

Type of learning outcomes	**The Learning Outcomes Descriptors**
Graduates should be able to demonstrate the acquisition of:	
Learning outcomes that are specific to disciplinary/inter disciplinary areas of learning	Demonstrate a deep understanding of the pathophysiology, diagnosis, and treatment of blood disorders such as anemia, leukemia, lymphoma, and other hematological diseases.
	Gain expertise in blood collection, storage, and transfusion practices, including blood typing, crossmatching, and donor screening.Understand the regulatory and ethical aspects of blood banking, including safety protocols, quality control, and compliance with national and international standards.
	Demonstrate the ability to manage transfusion therapy, including the selection and administration of blood products (e.g., red blood cells, platelets, plasma). Understand complications of blood transfusion such as transfusion reactions, immunohematology, and antibody screening.
	Work effectively with interdisciplinary healthcare teams (e.g., oncologists, pathologists, immunologists, and nurses) to provide comprehensive care to patients with hematological conditions.Communicate hematological findings to non-specialist professionals, such as primary care physicians, to ensure integrated patient care.
Generic learning outcomes	Critical Thinking and Problem-Solving: Develop the ability to critically analyze complex hematological and blood banking problems.Apply logical and evidence-based reasoning to diagnose, interpret, and manage hematological conditions.
	Research Skills and Methodology: Demonstrate proficiency in using modern research tools, statistical methods, and data analysis software.Critically appraise scientific literature, synthesize findings, and contribute to advancements in the field.
	Communication and Professionalism: Communicate complex hematological and blood banking concepts clearly and effectively, both verbally and in writing, to

	diverse audiences (e.g., clinicians, patients, researchers, and policy-makers).Demonstrate professional conduct in interactions with colleagues, patients, and the healthcare community.
	Ethical and Legal Awareness: Understand and apply ethical principles in the practice of hematology and blood banking, including patient consent, confidentiality, and social responsibility.Address ethical dilemmas in clinical or research settings with a clear understanding of their impact on patient care and the broader community.
	Lifelong Learning and Continuing Education: Develop a habit of lifelong learning, staying updated on advancements in hematology, blood banking, and related fields. Demonstrate the ability to self-reflect and engage in personal and professional development.
	Leadership and Management Skills: Develop leadership skills, particularly in managing laboratory operations, blood banking processes, or clinical hematology services.Understand the principles of healthcare management, quality assurance, and safety in clinical or laboratory settings.
	Cultural Sensitivity and Global Health Awareness: Develop an understanding of cultural differences and their impact on healthcare delivery, particularly in the context of blood donation and transfusion practices.
	Technical and Laboratory Proficiency: Gain proficiency in using advanced laboratory techniques and diagnostic tools in hematology and blood banking.
	Teaching and Mentorship: Develop the ability to teach and mentor students, healthcare professionals, or laboratory technicians in the field of hematology and blood banking.

Programme learning outcomes: A post graduate degree is awarded to students who have demonstrated the achievement of the outcomes located at level 6:

Element of the Descriptor	**Programme learning out comes relating to Post graduate degree (2years)**
The Post graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Advanced Knowledge of Hematology: Students will demonstrate an in-depth understanding of hematological concepts, including blood cell structure and function, hematopoiesis, and the pathophysiology of blood-related diseases (e.g., anemia, leukemia, lymphoma, clotting disorders). Hematology, blood physiology, and blood diseases.
	Mastery of Blood Banking Practices: Students will develop detailed knowledge of the principles and practices in blood banking, including blood donation, blood typing, crossmatching, blood product preparation, and transfusion safety protocols. Blood banking processes, donor selection, blood storage, transfusion medicine.
	Transfusion Medicine and Immunohematology: Students will acquire comprehensive knowledge of transfusion medicine, including immunohematology, blood product selection, compatibility testing, transfusion reactions, and the management of blood-borne infections. Immunohematology, transfusion safety, blood compatibility, and transfusion reactions.
	Ethical and Legal Knowledge in Hematology and Blood Banking: Students will develop a deep understanding of the ethical and legal aspects of hematology and blood banking, including patient consent, ethical decision-making in blood transfusion, and the legal framework governing blood banking practices. Medical ethics, legal issues in healthcare, patient rights in blood banking.
General, technical and professional skills required to perform and accomplish tasks	General Skills: Analytical reasoning, evidence-based decision-making, and problem-solving.
	Technical Skills: Precision in laboratory procedures, handling hematological diagnostic equipment, and managing sample preparation.
	Technological Proficiency: Operating diagnostic equipment, interpreting data from laboratory instruments, and integrating technology into clinical practice.
	Ethical and Legal Practices: Ethical decision-making, understanding legal regulations, and maintaining professional

	integrity.
Application of knowledge and skills	Assessing patient histories, interpreting diagnostic results, making treatment decisions based on evidence, and managing the overall care of patients with blood-related disorders. Performing blood typing, crossmatching, managing blood inventory, and ensuring the appropriate use of blood products in transfusion therapy. Blood product management, transfusion compatibility testing, and transfusion-related safety. Laboratory techniques, diagnostic test execution, data interpretation. Public health management, blood donation campaigns, blood-borne infection prevention.
Generic learning outcomes	Advanced Critical Thinking and Problem-Solving Skills: Analytical thinking, decision-making, clinical reasoning, and problem-solving in healthcare settings. Research and Evidence-Based Practice: Research design, data analysis, academic writing, critical review of literature, and application of evidence-based practices. Effective Communication Skills: Presentation skills, report writing, scientific communication, and patient interaction. Leadership and Management Skills: Leadership, team management, conflict resolution, and organizational skills.
Constitutional, humanistic, ethical, and moral values	Understanding and following national and international laws related to blood donation, blood transfusion safety, and public health protocols. Understanding and following national and international laws related to blood donation, blood transfusion safety, and public health protocols.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Proficiency in performing a wide range of hematological and blood banking laboratory tests, including blood typing, crossmatching, complete blood counts (CBC), and coagulation tests. Proficiency in performing a wide range of hematological and blood banking laboratory tests, including blood typing, crossmatching, complete blood counts (CBC), and coagulation tests. Adherence to ethical standards in managing patient information, obtaining informed consent, and providing treatments in the best interests of the patient.
Credit requirements	First 2 semesters of 2-year PG programme and earns 44 credits, then aPost Graduate Diploma in Hematology and Blood Banking

	willbe awarded.
Entry requirements	B.Sc. (Medical Laboratory Technology with atIeast 45% in the aggregate

Program Structure

SEMESTER: 1st									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
MHB1400	Basic Hematology	Core Course	4	0	0	4	30	70	100
MHB1401	Blood Banking	Core Course	4	0	0	4	30	70	100
MHB1402	Immune-hematology	Core Course	4	0	0	4	30	70	100
MHB1403	Basic Hematological Techniques	Practicum	0	0	8	4	30	70	100
IKS0022	Indian Cultural Studies	Indian Knowledge System	2	0	0	2	15	35	50
Discipline Elective (Any one of the following)									
MHB1405	Blood Donation & Blood Components	Disciplinary Elective	4	0	0	4	30	70	100
MHB1406	Clinical Biochemistry								
Total			**18**	**00**	**8**	**22**	**165**	**385**	**550**

SEMESTER: 2nd									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
MHB2450	Advance Hematology	Core Course	4	0	0	4	30	70	100
MHB2451	Transfusion Medicine	Core Course	4	0	0	4	30	70	100
MHB2452	Hematological Diseases	Core Course	4	0	0	4	30	70	100
MHB2453	Advance Hematological Techniques	Practicum	0	0	8	4	30	70	100
MHB2454	Project I	Skill Based	0	0	4	2	15	35	50
Discipline Elective (Any one of the following)									
MHB2455	Quality Control in Hematology	Disciplinary Elective	4	0	0	4	30	70	100
MHB2456	Recent Advances in Blood Banking								
Total			**16**	**0**	**12**	**22**	**165**	**385**	**550**

Programme learning outcomes: A post graduate degree is awarded to students who have demonstrated the achievement of the outcomes located at level 6:

Element of the Descriptor	**Programme learning out comes relating to Post graduate degree (2years)**
The Post graduates should be able to demonstrate the acquisition of:	
Knowledge and understanding	Transfusion Reactions: Understand the different types of transfusion reactions, including acute and delayed hemolytic reactions, allergic reactions, febrile non-hemolytic reactions, transfusion-related acute lung injury (TRALI), and transfusion-associated circulatory overload (TACO).
	Pathophysiology of Reactions: Comprehend the underlying pathophysiological mechanisms of transfusion reactions, such as immune system responses, antigen-antibody interactions, and cytokine release.
	Fundamentals of Immunohematology: Deep understanding of the principles of immunohematology, including antigen-antibody interactions, blood group systems (ABO, Rh, and other minor systems), and the implications of blood group incompatibility.
	Biostatistics Principles: Understanding key biostatistical concepts, such as descriptive statistics, hypothesis testing, confidence intervals, p-values, and statistical significance, and their application in hematology-related research.
	Research Ethics: Knowledge of ethical considerations in the conduct of scientific research, including honesty, integrity, transparency, and the avoidance of misconduct such as plagiarism, falsification, and fabrication of data.
	Protection and Commercialization of Research: Understanding how to protect and commercialize research innovations in the field of hematology, including the management of patents, licensing agreements, and collaborations with industry partners.
General, technical and professional skills required to perform and accomplish tasks	Critical Thinking and Problem-Solving: The ability to assess patient conditions, identify symptoms, and troubleshoot transfusion-related complications effectively.
	Utilization of Diagnostic Tools: Skill in using laboratory tests, such as crossmatch, antibody screens, and blood typing, to prevent and manage transfusion reactions.
	Patient-Centered Care: Prioritize patient safety by adhering to

	best practices in transfusion medicine and addressing complications with empathy and professionalism.
	Attention to Detail: Maintain high accuracy in performing immunohematology tests and interpreting results, particularly when identifying rare blood group antigens or antibodies.
Application of knowledge and skills	Identifying and Managing Transfusion Reactions: Students will be able to apply their understanding of the different types of transfusion reactions (e.g., hemolytic, allergic, TRALI) in a clinical setting to recognize early symptoms and intervene appropriately. Developing Protocols for Complication Prevention: Applying knowledge of transfusion reaction mechanisms, students can design and implement blood transfusion safety protocols to minimize the occurrence of complications in hospital or clinical blood banks. Improving Blood Bank Operations: Apply knowledge of immunohematology to improve blood bank practices, optimizing blood component selection based on patient needs, such as in rare blood group patients or cases requiring specialized products (e.g., antigen-negative blood). Data Collection and Analysis: Apply biostatistical methods to analyze research data, using tools such as SPSS, R, or SAS, to analyze complex clinical and laboratory data, interpret results, and make data-driven decisions.
Generic learning outcomes	Understanding Transfusion Reactions: Graduates will demonstrate a comprehensive understanding of the various types of transfusion reactions (e.g., allergic, hemolytic, TRALI, etc.), including their pathophysiology, risk factors, symptoms, and treatment options. Understanding Transfusion Reactions: Graduates will demonstrate a comprehensive understanding of the various types of transfusion reactions (e.g., allergic, hemolytic, TRALI, etc.), including their pathophysiology, risk factors, symptoms, and treatment options. Advanced Laboratory Skills: Graduates will be proficient in using advanced immunohematology techniques (e.g., molecular typing, antigen-antibody testing, solid-phase assays) for blood group identification, antibody screening, and resolving complex transfusion issues. Statistical Competence: Graduates will be skilled in applying biostatistical techniques, including regression analysis, hypothesis testing, and survival analysis, to interpret data in

	clinical and laboratory research.
Constitutional, humanistic, ethical, and moral values	Ensuring that all patients have equal access to high-quality transfusion therapy and that no discrimination occurs in the provision of care, following constitutional guidelines of equity and justice. Students learn the importance of providing compassionate care to patients experiencing transfusion reactions, offering emotional support, and involving patients in the decision-making process regarding treatment options. Understanding that some patients may require specialized blood products or care (e.g., rare blood groups), students are encouraged to approach these situations with extra care and consideration for vulnerable populations.
Employability and job-ready skills, and entrepreneurship skills and capabilities/qualities and mindset	Graduates will be able to make informed clinical decisions regarding blood transfusion therapy, identifying and managing transfusion reactions effectively, which are critical in clinical and hospital-based settings. Graduates will be able to make informed clinical decisions regarding blood transfusion therapy, identifying and managing transfusion reactions effectively. Graduates will be able to make informed clinical decisions regarding blood transfusion therapy, identifying and managing transfusion reactions effectively, which are critical in clinical and hospital-based settings. They could also develop and manage public health campaigns that encourage blood donation, collaborating with local governments, healthcare systems, and NGOs.
Credit requirements	A student will be awarded with Master of Science in Hematology and Blood Banking after successful completion of four semesters of 2-year PG Programme by earning 88 credits, OR A student will be awarded with Master of Science in Hematology and Blood Banking after successful completion of two semesters of 1-year PG Programme by earning 44 credits in the case of lateral entry to 2ndyear after 4-year Bachelor Degree (Honors) or 4-year Bachelor Degree (Honors with Research) or after 1-year PG Diploma in the concerned subject as per the eligibility Conditions.
Entry requirements	Bachelor's degree with Honors/Honors with Research in relevant subject (4-Years) or One-year PG Diploma in relevant subject with at least 45% marks or equivalent CGPA in

	aggregate, after 3-year Bachelor Degree.

SEMESTER: 3rd									
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
MHB3500	Transfusion Reaction and Complications	Core Course	4	0	0	4	30	70	100
MHB3501	Advances in Immunohematology Techniques	Core Course	4	0	0	4	30	70	100
MHB3502	Dissertation (Phase I)	Compulsory	0	0	0	12	200	100	300
MHB3503	Project II	Skill Based	0	0	4	2	15	35	50
Total			**08**	**00**	**04**	**22**	**275**	**275**	**550**

SEMESTER: 4th									
Course Code	**Course Title**	**Type of Courses**	**L**	**T**	**P**	**No. of Credits**	**Int.**	**Ext.**	**Total Marks**
MHB4550	Research Methodology and Biostatistics	Core Course	4	0	0	4	30	70	100
MHB4551	Dissertation (Phase II)	Skill Based	0	0	0	12	200	100	300
MHB4552	Employability and Entrepreneurship in Hematology and Blood Banking	EEC	2	0	0	2	15	35	50
Discipline Elective (Any one of the following)									
MHB4553	Biomedical Instrumentation	Disciplinary Elective	4	0	0	4	30	70	100
MHB4554	Research Publication Ethics and Intellectual Property Right								
Total			**10**	**0**	**0**	**22**	**275**	**275**	**550**
Grand Total			**52**	**00**	**24**	**88**	**880**	**1320**	**2200**

1st SEMESTER

Course Title: Basic Haematology	L	T	P	Cr.
Course Code: MHB1400	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.
5. Know the indications for bone marrow biopsy and aspirate.

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.

UNIT-III **16 Hours**

Hemoglobinometer- 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	L	T	P	Cr.
Course Code: MHB1401	4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students 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. Prepare various fractions of blood for transfusion and therapeutic purposes
4. Understand bacterial cell and eukaryotic cell; parallelism between genes and chromosomes.
5. Explain the significance of other blood group systems (e.g., Kell, Duffy, Kidd, MNS).

Course Contents

UNIT-I **14 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.

UNIT-II **14 Hours**

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 **16 Hours**

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 **16 Hours**

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: Immune-hematology	L	T	P	Cr.
Course Code: MHB1402	4	0	0	4

Total Hours: 60

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

1. Describe the basic principles of immunology related to blood group antigens and antibodies.
2. Explain the genetics and inheritance of blood group systems (e.g., ABO, Rh, Kell, Duffy).
3. Identify the mechanisms of immune response relevant to blood transfusion.
4. Understand the pathophysiology of haemolytic disease of the foetus and newborn (HDFN), autoimmune haemolytic anaemia (AIHA), and transfusion reactions.
5. Explain the process and significance of crossmatching and antibody screening.

Course Contents

UNIT-I **15 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 **15 Hours**

Blood Components and Functions: Blood composition and functions of different blood components, Hematopoiesis 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 **15 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, Lewis,P group.) 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 **15 Hours**

Immune Hematology: Autoimmune and allo-immune haemolyticanaemias, 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.*

Course Title: Basic Hematological Techniques (Practicum)	L	T	P	Cr.
Course Code: MHB1403	0	0	8	4

Total Hours 60

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

1. Demonstrate proficiency in performing basic hematological techniques, such as preparing blood smears, performing hemoglobin measurements, and using a hematology analyzer.
2. Perform and interpret hematocrit and hemoglobin measurements, explaining the clinical significance of these values in diagnosing various conditions (e.g., anemia, polycythemia).
3. Identify and distinguish between common hematological disorders, such as anemia, leukemia, and thrombocytopenia, based on laboratory findings and clinical symptoms.
4. Implement quality control measures and understand the importance of standardizing hematological tests to ensure accurate and reliable results.
5. Perform routine hematological procedures, including complete blood count (CBC), peripheral blood smear preparation and staining, hemoglobin estimation, and hematocrit measurement.

Course content

List of Practical's / Experiments: 60 Hours

1. Demonstration of- Microscopes, Hemocytometers, Colorimeter, Spectrophotometer**,** Glass pipettes & Auto pipettes, Glassware
2. To measure the number of reticulocytes (immature RBCs) in the blood.
3. To determine an individual's blood type (ABO and Rh).
4. To count and identify different types of white blood cells in a blood smear.
5. To calculate the reticulocyte index for evaluating bone marrow response.
6. To detect antibodies or complement proteins that are bound to red blood cells (RBCs).
    - Method:
        - Wash patient RBCs to remove unbound antibodies.
        - Add antihuman globulin reagent (Coombs reagent) and observe for agglutination.
7. To identify specific antibodies in a patient's serum using known red blood cell antigens.
8. To ensure that blood donations are free from infectious diseases.

- Method:
  - Screen blood donors for HIV, Hepatitis B, Hepatitis C, Syphilis, and other pathogens using serological or nucleic acid-based tests (e.g., ELISA, PCR).

9. To assess the fetal hemoglobin levels in the maternal blood as a marker of hemolytic disease.
10. Preparation of various anticoagulants: EDTA, Sodium Citrate, Oxalate with Fluoride
    - Urine Analysis:
      - Physical and Chemical Examination of Urine.
      - 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 Hematology. London: Churchill Livingstone*
- *Christopher, A. L. (1990) Clinical Hematology.*
- *John, B. H. (2001). Clinical Diagnosis &Management by Laboratory methods.*
- *McDonald, G.A. (1989). Atlas of hematology*
- *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: Indian Cultural Studies	L	T	P	Cr.
Course Code: IKS0022	2	0	0	2

Total Hours: 30

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

1. Understanding Modern Indian Thought: Students will gain a theoretical foundation to explore how Indian philosophical and cultural ideas since the early 20th century have shaped individual and collective experiences.
2. Analyzing Cultural Transformations: Learners will investigate the impact of modern Indian thought on personal identity and cultural context, understanding its role in shaping societal values and worldviews.
3. Developing Conceptual Vocabulary: Students will become familiar with key ideas and terminologies introduced in the course, enabling them to critically engage with and interpret modern Indian intellectual traditions.
4. Articulating Personal and Shared Experiences: Learners will cultivate the ability to express their own and others & experiences using the conceptual and philosophical frameworks discussed in the course.
5. Describe the key elements of Indian culture, including art, architecture, music, dance, festivals, and literature.

Course Content

Unit I **7 Hours**

Introduction: (Orientalist, colonial and contemporary representation of India)

Unit II **8 Hours**

Indian difference: (Aurobindo, Ramanujan, Bankimchandra, Malhotra and others),
Self and subjectivity: (Gandhi, Upadhyay, M.N. Roy, Ashis Nandy, Dharmapal and others)

Unit III **7 Hours**

Home, Nation and the World: (Nehru, Tagore, Ambedkar, Savarkar, Mazumdar,
Malaviya and others)

Unit IV **8 Hours**

Swaraj: (Lajpat Rai, Gandhi, Tilak, Rajaji, Alvares, Balagangadhar and others), Art and aesthetics: (Coomaraswamy, Hiriyana, Radhakrishnan,

Aurobindo, Naipaul, Devy and others)

Transactional Mode: Seminars, Group discussion, Team teaching, Focused group discussion, Assignments, Project-based learning, Simulations, reflection and Self-assessment

Suggested Readings:

- *Knut A. Jacobsen. Ed. Modern Indian Culture and Society. Routledge: London, 2009.*
- *Upadhyay, Deendayal. Integral Humanism. 1965. http://www.chitrakoot.org/download/IntegralHumanism.pdf*
- *Savarkar, V.D. The Essentials of Hindutva. http://savarkar.org/en/encyc/2017/5/23/2_12_12_04_essentials_of_hind tva.v001.pdf_1.pdf*
- *Vasudha Dalmia & Rashmi Sadana. Eds. The Cambridge Companion to Modern Indian Culture. Cambridge University Press: Cambridge, 2012.*
- *Alvares, Claude. "A Critique of the Eurocentric Social Science and the Question of Alternatives". Economic and Political Weekly. 46. 22, 2011.*
- *Ambedkar, B.R. Pakistan or the Partition of India. Columbia University: http://www.columbia.edu/itc/mealac/pritchett/00ambedkar/ambedkar_partition*
- *Balagangadhara,S.N. Reconceptualizing India Studies. Oxford University Press: New Delhi, 2012.*
- *Chatterjee, Partha. Nationalist Thought and the Colonial World: A Derivative Discourse. Zed Books: London,1993.*
- *Chattopadhyay, Bankimchandra. "Is Nationalism a Good Thing?" and "Critics of Hinduism". In Awakening Bharat Mata, ed. Swapan Dasgupta. Penguin: New Delhi, 2019.*
- *Coomaraswamy, A.K. "Indian Nationality". Indian Philosophy in English: From Renaissance to Independence. Oxford University Press: New York, 2011.*
- *Gandhi, M.K. Hind Swaraj. Navjeevan Publishing: Ahmedabad, 1938.*
- *Ghosh, Aurobindo. "A Defence of Indian Culture". The Renaissance in India and other Essays on Indian Culture. Sri Aurobindo Ashram: Pondicherry, 2002.*

Course Title: Blood donation and Blood components	L	T	P	Cr.
Course Code: MHB1405	4	0	0	4

Total Hours: 60

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

1. Explain the importance and impact of blood donation on healthcare and patient outcomes.
2. Describe the eligibility criteria for blood donation (age, weight, health conditions, etc.).
3. Explain the clinical indications for transfusion of each blood component.
4. Discuss compatibility testing and crossmatching principles.
5. Recognize potential risks and management of complications related to blood donation.

Course Content

UNIT-I **15 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 hemoglobin estimation Managing rejected blood donors, technique for conversion of first-time donor into regular voluntary donor, donor felicitation.

UNIT-II **15 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 **15 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.

UNIT-IV **15 Hours**

Plasma Fractionation: Principles, manufacturing of different plasma

derivatives Component Testing, Labeling, transportation and storage of blood components. Preparation of Leuk reduced 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: Clinical Biochemistry	L	T	P	Cr.
Course Code: MHB1406	4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students 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.
5. Understand the pathophysiological basis of biochemical abnormalities in common diseases (e.g., diabetes, renal failure, metabolic disorders).

Course Contents

UNIT-I **17 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 **13 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 **18 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.*

2nd SEMESTER

Course Title: Advance Haematology	L	T	P	Cr.
Course Code: MHB2450	4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students 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.
5. Understand advanced hematopoiesis: Describe regulation of blood cell production, including stem cell biology and growth factors.

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

Course Title: Transfusion Medicine	L	T	P	Cr.
Course Code: MHB2451	4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students 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.
5. Understand blood components: Know the indications, preparation, and storage of red cells, platelets, plasma, and cryoprecipitate.

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 hematology. 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. Blox ham, Oxfordshire: Scion.*

Course Title: Haematological Diseases	L	T	P	Cr.
Course Code: MHB2452	4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students 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.
5. Describe the normal development and function of blood cells (hematopoiesis).

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 hemolytic anemias. Immune, autoimmune and drug-induced immune hemolytic 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 hematopoietic 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.

Transactional modes: Video based teaching, Collaborative teaching, Case based teaching, Question Answer

Suggested Readings

- *Text book of Medical Laboratory Technology by Paraful B. Godkar*
- *Medical laboratory Technology by KL Mukherjee Volume-I*
- *Practical Hematology 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 Hematology in medical practice*

Course Title: Advance Hematological Technique (Practicum)	L	T	P	Cr.
Course Code: MHB2453	0	0	8	4

Total Hours 60

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

1. Perform complex hematological tests with proficiency, such as bone marrow aspirates, flow cytometry, hemoglobin electrophoresis, and blood film analysis.
2. Identify and troubleshoot common errors in hematology laboratory procedures, such as those associated with sample handling, equipment malfunctions, and result interpretation.
3. Adhere to laboratory safety protocols and demonstrate a thorough understanding of Good Laboratory Practice (GLP) in hematology.
4. Maintain a high level of professionalism and ethical conduct in the laboratory, ensuring patient confidentiality, accurate record-keeping, and safe laboratory practices.
5. Analyze and interpret laboratory results to diagnose various hematologic conditions, such as anemia, leukemia, and clotting disorders.

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

- To perform bone marrow aspirates and biopsy to evaluate hematopoiesis and diagnose hematological disorders such as leukemias, anemias, and myeloproliferative disorders.
- To identify hemoglobinopathies (e.g., sickle cell anemia, thalassemia) by separating hemoglobin variants.
- To prepare and examine peripheral blood films for the identification of blood cell abnormalities, parasites, and other hematological conditions.
- To assess the coagulation profile of patients and investigate clotting disorders (e.g., hemophilia, DIC).
- Screening tests for enzymes deficiency: Pyruvate Kinase, G6PD
- To estimate serum iron and total iron binding capacity.
- To estimate Hb-F, Hb-A2 in a given blood sample.
- To estimate plasma and urine Hemoglobin in the given specimens
- To classify different types of anemia (microcytic, macrocytic, hypochromic) based on reticulocyte count, iron indices, and blood smear findings.
- To perform routine quality control and calibration of automated hematology analyzers.
- To evaluate the deformability of red blood cells, which is crucial for conditions like sickle cell disease
- Estimation of Protein C, S

- To demonstrate Mixing experiments.
- 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: Project I	L	T	P	Cr.
Course Code: MHB2454	0	0	4	2

Total Hours 30

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

1. Students will be able to independently research a specific topic related to the field of study, identify key questions or problems, and gather relevant information from reliable sources.
2. Students will be able to design a clear and feasible project plan, including objectives, methodology, timeline, and resource management.
3. Students will demonstrate the ability to collaborate effectively within a team, contributing to group discussions, decision-making, and the completion of the project.
4. Students will reflect on their learning experiences throughout the project, evaluating their strengths and areas for improvement, and setting goals for future projects.
5. Demonstrate a thorough understanding of the core concepts related to the project topic.

List of Project I **30 Hours**

Advanced Hematology

- Flow Cytometry in Hematological Disorders – Hands-on training in immune phenotyping and data interpretation.
- Molecular Diagnostics in Hematology – PCR, RT-PCR, and NGS for detecting hematological malignancies.
- Automated Hematology Analyzers – Operation, maintenance, and troubleshooting of modern analyzers.
- Bone Marrow Aspiration and Biopsy Techniques – Sample collection, staining, and interpretation.
- Cellular and Molecular Markers in Leukemia – Detection of CD markers and genetic mutations.

Transfusion Medicine

- Advanced Blood Grouping and Antibody Identification – Serological and molecular techniques.
- Apheresis Techniques and Applications – Therapeutic plasma exchange, leukapheresis, and plateletpheresis.
- Platelet Storage and Function Assessment – Cold storage, swirling effect, and aggregation studies.
- Donor Selection, Phlebotomy, and Adverse Reaction Management – Training in blood donation procedures.
- Cord Blood Banking and Stem Cell Processing – Collection, cryopreservation, and clinical applications.

Hematological Diseases

- Diagnosis of Hemoglobinopathies – Electrophoresis, HPLC, and molecular methods.
- Thrombophilia and Hemostatic Disorders – Coagulation assays and genetic testing.
- Role of Extracellular Vesicles in Hematological Disorders – Isolation and analysis techniques.
- Genetic Counseling in Hematological Disorders – Case studies and patient management strategies.
- Point-of-Care Testing for Hematological Emergencies – Rapid diagnosis of anemia, sepsis, and DIC.

Quality Control in Hematology

- Internal and External Quality Assurance in Hematology – Proficiency testing and statistical evaluation.
- Risk Management and Error Reduction in Hematology Labs – Root cause analysis and CAPA implementation.
- Standardization and Validation of Hematology Tests – SOP development and accreditation guidelines.

Recent Advances in Blood Banking

- Artificial Blood and Blood Substitutes – Research and applications in trauma care.
- 3D Bioprinting of Hematopoietic Cells – Exploring regenerative medicine for blood disorders.

Course Title:Quality Control in Hematology	L	T	P	Cr.
Course Code: MHB2455	4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students 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.
5. Define quality control, quality assurance, and their importance in hematology laboratory settings.

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 bl ood 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.

UNIT-IV **15 Hours**

Statistical Process Control (SPC) in Hematology,Instrument Calibration and Maintenance, QC in Coagulation Testing, Blood Typing and Crossmatching QC, Error Sources and Troubleshooting in Hematology, Quality Control in Hematology Blood Banking, Risk Management in Hematology Laboratories.

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	L	T	P	Cr.
Course Code: MHB2456	4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students 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.
5. Learning about advancements in blood donation methods, such as automated blood collection and the use of better anticoagulants to improve donation safety and reduce the risk of complications for donors.

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

Unit-IV **15 Hours**

Blood Group Genotyping and Molecular Technologies, Innovative Blood Collection Methods,Pathogen Inactivation and Safety in Blood Transfusion, Advances in Transfusion Practices and Protocols. Emerging Technologies in Blood Banking, Future Directions and Challenges in Blood Banking.

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*

3RD SEMESTER

Course Title: Transfusion Reactions and Complications	L	T	P	Cr.
Course Code: MHB3500	4	0	0	4

Total Hours 60

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

1. Ability to identify signs and symptoms of different types of transfusion reactions like acute hemolytic reaction, febrile non-hemolytic reaction, allergic reaction etc.
2. Knowledge of the immunological and non-immunological mechanisms that can lead to transfusion reactions.
3. Understanding of proper techniques for administering blood and blood products.
4. Knowledge of post-reaction assessments to monitor patient status and ensure resolution of the reaction.
5. Describe the different types of transfusion reactions, including immediate (acute) and delayed reactions.

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 Preparation, 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 anaphylactoid 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: Advances in Immunohematology Techniques	L	T	P	Cr.
Course Code: MHB3501	4	0	0	4

Total Hours 60

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

1. Gain a deep understanding of the principles of immunohematology, including the major blood group systems (ABO, Rh, etc.), antigen-antibody reactions, and the molecular basis of blood group antigens.
2. Apply molecular techniques, such as PCR, sequencing, and genotyping, to identify blood group antigens and resolve complex blood group incompatibilities.
3. Demonstrate proficiency in performing complex blood typing and crossmatch testing using advanced laboratory technologies.
4. Understand the role of the immune system in blood bank practices, including the management of immune-mediated hemolytic disorders.
5. Describe the latest techniques in blood typing (e.g., molecular genotyping, microarray technologies).

Course Contents

Unit-I **15 Hours**

Overview of Immunohematology and Recent Advances: Introduction to Immunohematology and its significance in transfusion medicine,Advances in blood group serology,Role of monoclonal and polyclonal antibodies in immunohematology,Recent trends in red cell antigen-antibody reactions and Emerging challenges in transfusion medicine.

Unit-II **14 Hours**

Advanced Blood Group Typing and Antigen Characterization; Extended red cell phenotyping using molecular techniques, DNA-based blood group genotyping (PCR, RFLP, sequencing),Advanced monoclonal and polyclonal reagent development, Flow cytometry in immunohematology and Applications of microarray and biosensors in blood group typing.

Unit-III **16 Hours**

Modern Techniques in Antibody Screening and Identification: Solid-phase and column agglutination techniques,Bead-based multiplex assays,Luminex technology in blood banking,Advancements in elution and adsorption techniques,High-throughput screening for rare antibodies and Role of artificial intelligence in antibody identification.

Unit-IV **14 Hours**

Immunohematology Disorders and Advanced Diagnostic Approaches: Autoimmune hemolytic anemia: Novel detection methods, Paroxysmal nocturnal hemoglobinuria (PNH): Flow cytometry and molecular diagnosis, Hemolytic disease of the fetus and newborn (HDFN): Advances in non-invasive fetal DNA testing, Thalassemia and sickle cell disease: Advances in transfusion support and Latest approaches in transfusion-related immunomodulation.

Transaction Modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *"Immunohematology: Principles and Practice" by Betty A. Long, Judy L. Harmon, and Mary L. R. Colgan*
- *"Practical Transfusion Medicine" by Jeff E. D. Stoll, and Barbara J. M. D.*
- *"Immunohematology: A Clinical Approach" by Arthur E. S.*
- *"Advanced Immunohematology" by John A. DeWolf and Michael L. S.*
- *"The Blood Group Antigen FactsBook" by L. L. L. Daniels*

Course Title: Dissertation (Phase) I	L	T	P	Cr.
Course Code: MHB3502	0	0	24	12

Total Hours 180

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

1. Demonstrate an understanding of research methodologies used in hematology and blood banking, including qualitative and quantitative research methods, study designs, and data collection techniques.
2. Conduct a comprehensive literature review on a relevant research topic in hematology or blood banking, synthesizing current knowledge and identifying gaps or areas requiring further research.
3. Develop a well-structured research proposal, including a clear statement of the research problem, objectives, hypotheses, and methodologies.
4. Understand and apply ethical principles in research, including obtaining informed consent, ensuring patient confidentiality, and following ethical guidelines for research involving human subjects or animal models.
5. Critical Thinking and Problem-Solving: The ability to identify a research problem or question, critically analyze existing literature, and propose an original solution or investigation.

Course Content

Dissertation (Phase) I will include Synopsis approval from Doctoral Advisory Committee (DAC) will be taken by the student and after that it will send to Institutional Research Committee (IRC), followed by Institutional Ethical Committee (IEC) for final approval.

Course Title: Project II	L	T	P	Cr.
Course Code: MHB3503	0	0	4	2

Total Hours 30

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

1. Analyze complex research data using appropriate statistical tools and techniques, ensuring accurate interpretation of the findings.
2. Demonstrate advanced skills in conducting research within hematology and blood banking, including refining research methods and overcoming challenges that arose during Project I.
3. Demonstrate proficiency in scientific writing, ensuring clarity, conciseness, and logical flow of ideas, with proper referencing and adherence to ethical writing standards.
4. Ensure that the research adheres to ethical standards, including respect for participant confidentiality, informed consent, and compliance with regulations governing human subjects or animal research. Recognize and understand the protocols for blood collection, donor screening, and blood donation procedures.
5. Apply appropriate theoretical and methodological frameworks to investigate or address the problem.

Course Content

List of Project I **30 Hours**

- Recognition and Management of Acute Transfusion Reactions
- Delayed Transfusion Reactions: Causes, Diagnosis, and Prevention
- Infectious Complications of Blood Transfusion
- Immunological Complications of Transfusion
- Iron Overload in Repeated Transfusions: Monitoring and Management
- Massive Transfusion Protocols and Coagulopathy Management
- Graft-versus-Host Disease (GVHD) in Transfusion and its Prevention
- Neonatal and Pediatric Transfusion Complications
- Hemovigilance and Quality Control in Transfusion Reactions
- Artificial Blood Substitutes and Alternatives to Transfusion
- Advanced Blood Group Typing and Genotyping Techniques
- Automation in Blood Banking: Robotics and AI Applications
- Multiplex Assays for Blood Group Antibody Screening
- Cold Agglutinin and Warm Autoimmune Hemolytic Anemia Testing
- HLA Typing and Crossmatching for Stem Cell and Organ

Transplantation

- Platelet Immunology and Refractoriness Testing
- Detection and Management of Rare Blood Group Antibodies
- Ex-vivo Expansion of Red Blood Cells and Platelets for Transfusion
- Cellular and Immune-Based Therapies in Blood Transfusion
- Regulatory and Ethical Considerations in Immunohematology and Transfusion Medicine

4th Semester

Course Title:Research Methodology and Biostatistics	L	T	P	Cr.
Course Code: MHB4550	4	0	0	4

Total Hours 60

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

1. Demonstrate a comprehensive understanding of the principles of research methodology, including different types of research designs (e.g., experimental, observational, descriptive, analytical) and their appropriate applications in the field of hematology and blood banking.
2. Understand the importance of sample size, sampling methods (e.g., random, stratified, convenience), and study population in ensuring the validity and reliability of the research outcomes.
3. Recognize different types of research designs (e.g., experimental, observational, cohort studies, case-control studies).
4. Identify and address ethical issues that may arise in biomedical research, particularly in the context of human blood samples, clinical studies, and patient consent.
5. Apply appropriate statistical methods to analyze research data, including t-tests, chi-square tests, ANOVA, correlation, regression analysis, and survival analysis.

Course Contents

Unit-I **15 Hours**

Introduction to Research: Definition of Research, Types & Methods of research Applied versus Fundamental research, exploratory research, Observational research, Inductive and Deductive approaches; Designing Research protocol: Research Protocol Development, Literature search, Identification of Research problem, Research gap, Research question, Research Hypothesis, Null and Alternative Hypothesis, Study Objectives; Data and types: Types of Data, Primary and Secondary data, Scales of measurement of data- Nominal data, Ordinal, Interval and Ratio scale, Variables and Confounders, Dependent and Independent Variables, Extraneous variable, Control variable.

Unit-II **15 Hours**

Literature Review: Importance of literature review, Sources of literature: Journals, books, and online databases, Organizing and synthesizing research findings; Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Different Research Designs, Basic Principles of Experimental Designs; Study population: Selecting Cases and

Control, Comparison Group, Target population, Matching, Case Definition, Inclusion and Exclusion Criteria;Qualitative vs. Quantitative research methods; Data Collection and analysis : Types and sources of data – Primary and secondary, Methods of collecting data, Concept of sampling and sampling methods – sampling frame, sample, characteristics of good sample, simple random sampling, purposive sampling, convenience sampling, snowball sampling.

Unit-III **15 Hours** Statistics: Measures of central tendency: Mean, median, and mode, Measures of dispersion: Range, variance, and standard deviation, Frequency distributions and histograms, Data visualization: Bar charts, pie charts, and box plots; Probability and Probability Distributions: Basic probability concepts, Probability distributions: Normal distribution, binomial distribution, and Poisson distribution, Law of large numbers and central limit theorem.

Unit-IV **15 Hours** Chi-square test for independence and goodness of fit, One-way and two-way analysis of variance (ANOVA), Post-hoc tests following ANOVA; Regression Analysis: Simple linear regression, Multiple linear regression, Model assumptions and diagnostics, Logistic regression (binary outcomes), Poisson regression (count data); Biostatistics for Clinical Trials: Design and analysis of clinical trials, Randomization techniques, Statistical monitoring of trials, Regulatory considerations (e.g., FDA guidelines.

Transaction Modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *"The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. Williams*
- *"Research Methods in Education" by Louis Cohen, Lawrence Manion, and Keith Morrison*
- *"Research Methods in Hematology" by B.L. Pati and D.P. Mahapatra*
- *"Medical Research: A Guide for the Student and Researcher" by Ian D. Young*

Course Title: Dissertation (Phase II)	L	T	P	Cr.
Course Code: MHB4551	0	0	24	12

Total Hours 180

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

1. Utilize advanced research methods and tools to analyze and interpret complex data, showing an understanding of the latest developments and trends in the field.
2. Synthesize and integrate findings from primary research with existing literature to provide a coherent discussion on the topic.
3. Structure the dissertation in a logical manner, including introduction, literature review, research methodology, results, discussion, conclusion, and recommendations.
4. Demonstrate the ability to conduct independent, in-depth research using appropriate methodologies.
5. Adhere to ethical guidelines in the execution and reporting of research, ensuring that research involving human subjects, blood samples, or clinical data complies with ethical standards (e.g., informed consent, confidentiality, data protection).

Course Content

Dissertation (Phase) II - Dissertation will be evaluated for **300 marks** on the parameter laid down in the proforma for the evaluation in which the students will give a presentation on the dissertation and an open viva-exam examination will be conducted by the external examiner. Student will submit three hard copies of her/his dissertation along with soft copy as PDF file to the Department and 1 Review & Research paper based on his/her research work.

Course Title: Employability and Entrepreneurship Skill in Hematology and Blood Banking	L	T	P	Cr.
Course Code: MHB4552	2	0	0	2

Total Hours 30

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

1. To develop employability skills required for a successful career in hematology and blood banking.
2. To equip students with entrepreneurship skills for setting up and managing blood banks, diagnostic labs, and biotech startups.
3. To enhance communication, leadership, and problem-solving skills relevant to the healthcare industry
4. Understand the core concepts of hematology, including the structure and function of blood, blood cells, and related diseases.
5. To provide an understanding of financial management, regulatory policies, and business strategies for healthcare ventures.

Course Contents

Unit-I **7 Hours**

Career opportunities in hematology and blood banking,Essential soft skills: Communication, teamwork, adaptability, and leadership,Resume writing, job applications, and interview techniques,Professional ethics and work culture in healthcare and diagnostics and Digital skills: Use of technology in healthcare, data management, and reporting.

Unit-II **7 Hours** Laboratory quality assurance and accreditation (NABL, CAP, AABB standards),Good Laboratory Practices (GLP) and Good Manufacturing Practices (GMP),Automation and AI in hematology and transfusion medicine,Role of biomedical research and innovation in career advancement and continuing medical education (CME) and professional certifications.

Unit-III **7 Hours**

Fundamentals of Entrepreneurship in Healthcare:Basics of entrepreneurship and business models in healthcare,starting a blood bank, diagnostic laboratory, or biotech startup,identifying business opportunities and market analysis in blood banking,Writing a business plan: Key components and strategic planning and Risk assessment and management in healthcare entrepreneurship.

Unit-IV **9 Hours**

Basics of financial management for healthcare businesses,Funding

opportunities: Government grants, venture capital, and crowdfunding,Health economics and pricing strategies for diagnostic services,Regulatory frameworks for blood banking and diagnostic startups (FDA, WHO, ICMR guidelines) and Ethical considerations and legal aspects in healthcare entrepreneurship.

Transaction Modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *"The 7 Habits of Highly Effective People" by Stephen R. Covey*
- *"Crucial Conversations: Tools for Talking When Stakes Are High" by Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler*
- *"The Power of Habit: Why We Do What We Do in Life and Business" by Charles Duhigg*
- *"The Hard Thing About Hard Things: Building a Business When There Are No Easy Answers" by Ben Horowitz*
- *"Good to Great: Why Some Companies Make the Leap... and Others Don't" by Jim Collins*
- *"Grit: The Power of Passion and Perseverance" by Angela Duckworth*

Course Title: Biomedical Instrumentation	L	T	P	Cr.
Course Code: MHB4553	4	0	0	4

Total Hours 60

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

1. Demonstrate a deep understanding of the fundamental principles and working mechanisms of various biomedical instruments, including sensors, transducers, and analyzers.
2. Identify various types of biomedical instruments used in hematology (e.g., automated hematology analyzers, centrifuges, electrophoresis machines) and blood banking (e.g., blood typing machines, blood storage refrigerators, and platelet agitators).
3. Understand and implement appropriate calibration and maintenance procedures to ensure accurate and reliable performance of biomedical instruments.
4. Identify and explain the fundamental concepts behind the operation of key medical devices (e.g., ECG, EEG, pacemakers, imaging devices).
5. Analyze how various biomedical instruments influence blood banking practices such as blood typing, crossmatching, donor screening, and blood product processing.

Course Contents

Unit-I **15 Hours**

Introduction to Biomedical Instrumentation,Basics of biomedical instrumentation in haematology and blood banking, Classification of instruments: Analytical, Diagnostic, and Monitoring Equipment, Bioelectric signals and their measurements, Safety protocols and regulatory guidelines in biomedical instrumentation.

Unit-II **15 Hours**

Optical and Spectrophotometric Techniques:Principles of spectrophotometry, Use of UV-Vis spectrophotometers in haemoglobin estimation, Nephelometry and Turbidimetry for protein and antigen detection, Fluorescence and chemiluminescence in blood component analysis.

Unit-III **15 Hours**

Hematology Analyzers and Automation:Introduction to automated hematologyanalyzers,Coulter Principle and Electrical Impedance in cell counting,Laser-based Flow Cytometry: Working principle and applications,Hematocrit measurement techniques,Reticulocyte counting and automated differential leukocyte counting.

Unit-IV **15 Hours**

Coagulation and Blood Banking Instruments:Coagulation analyzers: Prothrombin Time (PT), Activated Partial Thromboplastin Time (aPTT), Thromboelastography (TEG) and Rotational Thromboelastometry (ROTEM), Blood bank refrigerators and plasma freezers, Cryopreservation of blood components and stem cells, Blood bag separator and apheresis technology.

Transaction Modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *"Biomedical Instrumentation: Technology and Applications" by Omer A. Faruk and Shashank A. Joshi*
- *"Introduction to Biomedical Equipment Technology" by Joseph J. Carr and John M. Brown*
- *"Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer*
- *"Fundamentals of Biomedical Instrumentation" by David Prutchi and Michael Norris*
- *"Principles of Biomedical Instrumentation and Measurement" by Richard Aston*

Course Title:Research Publication Ethics and Intellectual Property Right	L	T	P	Cr.
Course Code: MHB4554	4	0	0	4

Total Hours 60

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

1. Demonstrate a clear understanding of fundamental ethical principles in research, including honesty, integrity, transparency, and respect for intellectual property.
2. Recognize the role of academic journals in publishing high-quality, ethical research findings and their significance in advancing knowledge in blood-related diseases, transfusion medicine, and hematological diagnostics.
3. Understand the guidelines for determining authorship and the roles and responsibilities of co-authors.
4. Understand the importance of maintaining research integrity in all aspects of research, from data collection and analysis to reporting findings.
5. Learn how to protect research findings, inventions, and discoveries through appropriate intellectual property protection mechanisms (e.g., filing patents, copyright registration) and how to respect the intellectual property of others.

Course Contents

Unit-I **15 Hours**

Scientific Writing: Structure of a scientific paper (Title, abstract, introduction, methodology, results, discussion, conclusion); Writing a research proposal: Objectives, methodology, expected outcomes, Academic writing style and language (Clarity, conciseness, and logical flow), Citation and referencing: Understanding various citation styles (APA, MLA, Chicago, etc.), Reference management tools.

Unit-II **15 Hours**

Plagiarism: Types, plagiarism detection software, Publication misconduct and Publication Ethics, Plagiarism avoiding techniques, regulation of plagiarism in India; Publication Ethics: Integrity and Ethics, Best Practices, Intellectual Honesty & Research Integrity: Scientific Misconducts & Redundant Publications, Conflict of Interest, Publication Misconduct, Violation of Publication Ethics, Authorship and Contributorship; Identification of Publication Misconduct: Fabrication, Falsification and Plagiarism (FFP),Predatory Publishers & Journals.

Unit-III **15 Hours**

Open Access Publishing: Concept of OER, Concept of open license, Open access publishing, Open access content management; Database and Research Metrics: Indexing Databases, Citation Databases: Web of Science, Scopus, Google Scholar, Metrics: h-index, g-ind, i10 index,Understanding Citation Metrics for Quality Research: Impact & Visualization Analysis; Peer Review and Journal Selection: Understanding the peer-review process, Types of journals: Open access vs. subscription-based journals, How to select a journal for publication, Writing a cover letter and responding to reviewer comments.

Unit-IV **15 Hours**

Intellectual Property Rights (IPR): Definition and types of intellectual property (IP): Copyright, patents, trademarks, and trade secrets; The importance of IP in research and innovation, Historical development and international IP laws (e.g., the role of WIPO, TRIPS Agreement); Key IP terms: Patentable inventions, originality, novelty, and industrial applicability; Patents: Overview of the patent system: Types of patents, Steps involved in obtaining a patent: Application, examination, and grant, Patentability requirements: Novelty, non-obviousness, and usefulness, Patent infringement and enforcement; Licensing and Commercialization of IP: Types of IP licenses: Exclusive vs. non-exclusive licenses, Licensing agreements and revenue sharing, Commercialization of research findings: Startups, spin-offs, and patent exploitation, Technology transfer offices: Role in university-based IP commercialization; Patent issues in academic research: Balancing public knowledge with commercial interests, Ethical concerns in patenting research outcomes, Impact of IP laws on collaborative research, IP in publicly funded research.

Transaction Modes: Video based teaching, Collaborative teaching, Case based teaching, Question-Answer

Suggested Readings

- *"Intellectual Property and Health Technologies: Balancing Innovation and the Public Interest" by Peter Drahos and John Braithwaite*
- *"The Ethics of Scientific Research: A Guidebook for Course Development" by B. H. Dubois*
- *"Research Ethics: A Handbook of Principles, Guidelines, and Procedures" by Barbara S. Smith*
- *"The Craft of Research" by Wayne C. Booth, Gregory G. Colomb, and Joseph M. William*