COURSE OF STUDIES

for

Master of Philosophy

in

<Haematology>

UNIVERSITY OF HEALTH SCIENCES, LAHORE PAKISTAN

Program Rationale:

To become the center of excellence for teaching, research and diagnostics at both national and international levels in order to provide the best possible patient care

Mission Statement:

- To train the highly competent haematologists and blood bank specialists.
- To create a framework for undergraduates and postgraduates to pursue their future career goals through research and clinical training.
- To become Pakistan's leading research center in the field of haematology, clinical haematology and transfusion medicine.

Program Educational Objectives:

Trainees will require the satisfactory completion of a structured training program in both Haematology as well as transfusion medicine. The objective of this training curriculum is to ensure a continuum in the acquisition of knowledge and skills in

- Red blood cell disorders
- White blood cell disorders
- Platelet and coagulation disorders
- Transfusion medicine

1. To enhance the basic understanding of the subject so that they can diagnose Hematological disorders.
2. To inculcate the utilization of new knowledge and technologies and their adoption according to local conditions.
3. To establish effective collaboration with other institutes and research centers for the benefit of the post-graduates to harness new technologies and increase their vision.
4. To enable the post-graduates to present their research findings effectively at National/International forums.
5. To pursue higher studies in any international university of high repute.

Program Learning Outcomes:

At the end of the session, the students will be able to

- Understand the basic and up-to-date knowledge of blood and bone marrow disorders to investigate patients as an independent practitioner.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of hematological and non-hematological disorders. (Anaemias, Leukaemias, Lymphomas, lysosomal disorders, storage pool diseases, inherited and acquired bleeding disorders).
- Demonstrate the basic knowledge of transfusion medicine (blood group antigens, antibodies & diseases resulting from their interaction, blood group, HLA and platelet serology and its practical implications, blood and marrow donation, processing, storage & dispensing etc.).
- Illustrate the ability to perform all routine laboratory investigations and can interpret their results.
- Demonstrate the ability to perform all specialized and emergency hematological investigations and to organize and manage quality control in hematology and blood transfusion service.
- Understand the principles, and procedures of different methods and techniques (cytogenetics, molecular biology, immunology, nuclear medicine etc.) in diagnosing and managing hematological disorders.
- Apply and integrate the qualities of an effective teacher, team worker and leader.
- Summarize the knowledge and understanding of medical governance and audit.
- Develop the need for continuing professional development for the maintenance of standards of practice.
- Communicates effectively and can share decision-making, while maintaining appropriate situational awareness, professional behavior and professional judgment.
- Develop patient safety and effective quality improvement in patient care

- Produce well-trained specialists for Primary and Secondary Health care centers.
- Demonstrate the contribution of excellent research to society and the economy for the benefit of individuals, organizations and nations.
- Improve the university's fame and ranking at the National and international level with high-quality research work.
- To generate highly competent hematologists to qualify for higher studies at the international level

SCHEME OF STUDIES (2-Year)

MS/MPhil__Hematology_____

Semester #	Course code	Course title	Credit hours		
			Theory	Practical	Total
1	RM 701	Biostatistics and Research Methodology	2	0	2
	HEM701	Hematopoiesis, Nutritional Anemia & Disorders of iron, B12 & Folate metabolism	1	1	8
	HEM702	Hemolytic anemia & Hemoglobinopathies	1	1	
	HEM703	Bone Marrow Failure syndromes & Systemic disorders + WBCs Benign disorders	1	1	
	HEM706	Laboratory and Quality Management	1	1	
		Elective Course 1	2	0	2
2	HEM704	Malignant WBCs disorders (Leukemias, Lymphoproliferative disorders, MDS, Lymphomas & Plasma cell dyscrasias)	1.5	1.5	8
	HEM705	Platelet & Coagulation disorders	1.5	1	
	HEM707	Transfusion Medicine	1.5	1	
		Elective Course 2	2	0	2
3	Research (thesis)		6		6
4	Professional & Teaching Skills Apprenticeship (PTSA) a. Professional Skills (Clinical & Microscopy) b. Teaching Skills		0 0	1 1	2
(Total: 30)					

LIST OF COURSES

Major Courses

HEM701: Hematopoiesis, Nutritional Anemia & Disorders of iron B12 & Folate metabolism

HEM702: Hemolytic anemia & Hemoglobinopathies

HEM703: Bone Marrow Failure syndromes, Systemic disorders & Benign Disorders of WBCs

HEM704: Malignant WBCs disorders

HEM705: Platelet & Coagulation disorders

HEM706: Quality Assurance and Management

HEM707: Transfusion Medicine

HEM708: Clinical & Microscopy skills

Elective 1

General Pathology

Elective 2

(Students need to choose from following options)

- Microbiology
- Chemical Pathology
- Morbid anatomy & Histopathology
- Immunology

DETAIL OF COURSES

Course Title

Hematopoiesis, Nutritional Anemia & Disorders of iron, B12 & Folate metabolism

Course code

HEM701

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)	=	18	Theory	=	1
Practical (Clinical lab work)	=	54	Practical	=	1
Total	=	72	Total	=	2

Course Objective:

By the end of the course, students should be able to:

- Demonstrate a foundational understanding of hematopoiesis.
- Illustrate comprehensive knowledge of the etiology, pathophysiology, clinical features, and laboratory investigations of Iron Deficiency Anemia and Megaloblastic Anemia.
- Demonstrate understanding of the etiology, pathophysiology, clinical features, and laboratory investigations of iron metabolism disorders.
- Demonstrate understanding of the etiology, pathophysiology, clinical features, and laboratory investigations of quantitative and qualitative hemoglobin disorders.

Learning outcomes:

KNOWLEDGE

The student will be able to

- Demonstrate the basic knowledge of hematopoiesis
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of Iron Deficiency anaemia and Megaloblastic anemia

- Demonstrate the etiology, pathophysiology, clinical features and laboratory investigations of iron metabolism disorder.
- Demonstrate the etiology, pathophysiology, clinical features and laboratory investigations of quantitative and qualitative hemoglobin disorder.

ASSESSMENT TOOL

MCQs/SEQs

CLINICAL SKILLS:

Students will

- Differentiate and analyze the test result of Microcytic anemias
- Identify and explain the test result of macrocytic anemia
- Describe and analyze different methods for assessing iron status
- Demonstrate Schilling test
- Identify and explain Perls stain
- Identify abnormalities of Red Cell, White Cell and Platelet in morphology, CBC analyzer report

ASSESSMENT TOOL

OSPE/DOPS/TOACS/CBD

Course outline:

Origin and development of blood cells
- Hematopoetic organs
- Hematopoetic stem cells
- Committed hematopoietic “progenitor cells
- Hematopoietic growth factors/cytokines

Erythropoiesis
- Erythroid cells
- Biosynthesis of hemoglobin
- Control of erythropoiesis

The Mature red cell (shape, dimensions, structure)
- Hemoglobin and erythrocyte function
- Energy metabolism

Destruction of erythrocytes
- Site and mechanisms of erythrocyte destruction
- Hemoglobin catabolism

- Laboratory evaluation of hemoglobin catabolism and bile pigments

DISORDERS OF RED CELLS

- General aspects of anemia
- Definition
- Clinical manifestations
- Pathophysiology
- Classification and morphology
- Diagnostic approach
    - Macrocytic anemia
    - Hypochromic microcytic anemia
    - Normochromic normocytic anemia

Iron deficiency anemia

- Stages of development of iron deficiency
- Etiology and pathogenesis
- Clinical manifestations
- Laboratory findings

Megaloblastic and other Macrocytic anemias

- Vitamin B12 and Folate deficiency (Causes, clinical findings, pathogenesis and laboratory diagnosis)
- Pernicious anemia (Prevalence, Etiology and pathogenesis, Clinical manifestations & Laboratory findings)

Anemia in pregnancy

Anemia unique to infancy and childhood

Sideroblastic Anemias

- Heme synthesis in red cells
- Etiology
- Laboratory findings

Pancytopenia, Bone marrow failure syndromes, Congenital / Acquired

- Pathophysiology
- Etiology
- Symptoms and signs
- Lab diagnosis

Methemoglobinemia

Iron overload

- Hemochromatosis

Porphyrias

- Classification
- Causes
- Pathogenesis
- Diagnosis

Practicals:

1. Serum Iron
2. Serum ferritin
3. TIBC & % saturation
4. Serum transferrin

5. Serum & red cell folate
6. Serum B12 assays
7. Schilling test
8. Perls stain
9. Case Studies:
   Integrate case studies into assessments to evaluate the application of knowledge in real-life scenarios.

Recommended Books:

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
3. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
4. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
5. Robbins & Cotran Pathologic Basis of Disease 10th Edition by Vinay Kumar, Abul Abbas, Jon Aster10th Edition by Vinay Kumar, Abul Abbas, Jon Aster
6. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
7. de Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
8. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
9. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
10. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

Course title

Hemolytic anemia & Hemoglobinopathies

Course code

HEM702

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)	=	18	Theory	=	1
Practical (Clinical lab work)	=	54	Practical	=	1
Total	=	72	Total	=	2

Course Objective:

By the end of the course, students should be able to:

- Define and explain the concept of hemolytic anemias.
- Identify common characteristics shared by various types of hemolytic anemias.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations specific to membrane defects in hereditary hemolytic anemias.
- Demonstrate understanding of the etiology, pathophysiology, clinical features, diagnostic criteria, and laboratory investigations related to enzyme deficiencies in hereditary hemolytic anemias.
- Demonstrate understanding of the etiology, pathophysiology, clinical features, diagnostic criteria, and laboratory investigations specific to Thalassemia Syndromes.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations associated with Unstable Hemoglobins.
- These course objectives aim to guide the learning process and ensure that students develop a comprehensive understanding of hemolytic anemias, including membrane defects, enzyme deficiencies, Thalassemia Syndromes, and Unstable Hemoglobins, as outlined in the provided learning outcomes.

Learning outcomes:

KNOWLEDGE

At the end of the course, the student will be able to

- Demonstrate the basic knowledge of Hemolytic anemias
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of membrane defects in hereditary haemolytic anaemias.
- Demonstrate the etiology, pathophysiology, clinical features, diagnostic criteria and laboratory investigations of enzyme deficiencies in hereditary haemolytic anaemias.
- Demonstrate the etiology, pathophysiology, clinical features, diagnostic criteria and laboratory investigations of Thalassemia Syndromes.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of Unstable haemoglobins

ASSESSMENT TOOL

MCQs/SEQs

CLINICAL SKILLS:

Students will

- Apply and analyze the test result of normocytic anemia
- Identify and interpret reticulocyte count,
- osmotic fragility, G6PD assay, sickling, haemoglobin electrophoresis, HAMs, Kleihauer test

ASSESSMENT TOOL

OSPE/DOPS/TOACS/CBD

Course Outlines:

Hemolytic Anemias : General Consideration

- Definition
- Classification
- Clinical manifestations
- Laboratory diagnosis

Hereditary Spherocytosis And Other Membrane Disorders

- Genetics
- Pathogenesis
- Clinical features
- Laboratory diagnosis
    - Hereditary elliptocytosis
    - Hereditary stomatocytosis

Hereditary Hemolytic Anemias associated with abnormalities of erythrocyte glycolysis and nucleotide metabolism

G-6 PD deficiency

- Genetics and distribution
- The enzyme and its variants
- Pathophysiology
- Clinical features
- Diagnosis

Related disorders of hexose monophosphate shunt and glutathione metabolism

Pyruvate kinase deficiency

- Geographic distribution
- Genetics
- Pathophysiology
- Clinical features

- Diagnosis

Abnormalities of purine and pyrimidine nucleotide metabolism

Immune Hemolytic Anemias

Mechanisms of immune destruction of RBC

- Complement system
- Destruction of IgM and IgG antibodies
- Demonstration of anti-red cell antibodies

Allo-immune hemolytic disease of fetus and newborn.

- Pathogenesis of maternal Rh allo-immunization
- Pathogenesis of Rh hemolytic disease and other fetal hemolytic disease
- Severity of Rh hemolytic disease
- Antibody detection and measurement
- Other hemolytic disorders
- Prevention

Auto-immune hemolytic anemia

- Classification
- Etiology
- Clinical features
- Laboratory Diagnosis

Acquired Hemolytic Anemias

- Infectious agents
    - Malaria
    - Other infections
- Chemical agents,drugs & venoms
- Physical agents
- Red cell fragmentation syndromes
    - Large vessel abnormalities
    - Small vessel disease
    - Thrombotic microangiopathy
    - Malignant hypertension
- March hemoglobinuria

Paroxysmal Nocturnal Hemoglobinuria

- Etiology and pathogenesis
- Clinical manifestations
- Laboratory findings
- Differential diagnosis

Acute Post Hemorrhagic Anemia

- Clinical description
- Pathophysiology

- Hematological finding
- Diagnosis

Hemoglobinopathies

The Abnormal Hemoglobins - General Principles

- Classification
- Genetic mechanism and molecular pathology
- Pathophysiology
- Hemoglobin C disorders
- Hemoglobin D disorders
- Hemoglobin E disorders

Sickle Cell Anemia

- Hemoglobin S- prevalence and distribution
- Pathophysiology
- Clinical features
- Laboratory diagnosis
- Sickle cell trait
- Other sickling syndromes
- Prevention

Thalassemias and Related Disorders

- Prevalence and geographic distribution
- Genetic mechanisms and molecular pathology
- Pathophysiology
- Clinical and laboratory features of
    - Alpha thalassemia
    - Beta thalassemia
    - Hereditary persistence of fetal hemoglobin
    - Hb Lepore syndromes
- Diagnosis and differential diagnosis
- Prevention

Practicals:

1. Reticulocyte count
2. Osmotic fragility
3. G6PD assay
4. Demonstration of haemosiderin
5. Coomb's Test
6. Demonstration of unstable hemoglobin
7. Case study of Immune & non immune haemolytic anaemias

Recommended Books

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan

2. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
3. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
4. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
5. Robbins & Cotran Pathologic Basis of Disease 10th Edition by Vinay Kumar, Abul Abbas, Jon Aster10th Edition by Vinay Kumar, Abul Abbas, Jon Aster
6. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
7. Bone Marrow Pathology 5th Edition by Barbara J. Bain
8. de Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
11. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

Course title

Bone Marrow Failure syndromes, Systemic disorders & WBCs benign disorders

Course code

HEM703

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)=	18		Theory	=	1
Practical (Clinical lab work)	=	54	Practical	=	1
Total	=	72	Total	=	2

Course Objectives:

By the end of the course, students should be able to:

- Demonstrate adequate knowledge of the etiology, pathophysiology, clinical features, and laboratory investigations specific to inherited BMF syndromes.
- Differentiate between various inherited BMF syndromes based on their characteristics.
- Identify and explain the etiology, pathophysiology, clinical features, and laboratory investigations of acquired aplastic anemia and paroxysmal nocturnal hemoglobinuria (PNH).

- Differentiate between acquired and inherited forms of bone marrow failure.
- Identify and explain the etiology and pathophysiology of hematological changes during pregnancy and in neonates.
- Understand the impact of maternal and neonatal hematological conditions on clinical outcomes.
- Demonstrate an understanding of hematological changes associated with various systemic diseases.
- Analyze and interpret the hematological parameters in the context of systemic illnesses.
- Demonstrate a basic knowledge of leukopoiesis, including the stages and regulation of white blood cell formation.
- Understand the role of leukocytes in the immune response.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of benign white blood cell disorders.
- Differentiate between various benign disorders affecting white blood cells.

Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

1. Demonstrate adequate knowledge of the aetiology, pathophysiology, clinical features and laboratory investigations of inherited BMF syndromes.
2. Identify and explain the etiology, pathophysiology, clinical features and laboratory investigations of acquired aplastic anemia and PNH.
3. Identify and explain the etiology and pathophysiology of Pregnancy and neonatal hematology.
4. Demonstrate the Hematological changes in systemic diseases
5. Demonstrate the basic knowledge of Lecopoiesis
6. Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of benign white blood cell disorders.

Assessment Tool

MCQs/SEQs

CLINICAL SKILLS:

Following clinical skills are acquired after training on respective benches:

1. Carry out specified methods of bone marrow aspiration and trephine biopsy and do preliminary reporting. Independently perform bone marrow aspiration and trephine biopsy
2. Do independent reporting of bone marrow aspiration and trephine biopsy samples.
3. Demonstrate the DEB/MMC chromosomal breakage test

a. Analyze and interpret cytochemical stains such as Sudan Black B, Myeloperoxidase, Periodic Acid Schiff, Alpha Naphthyl Acetate Esterase, Acid Phosphatase, Neutrophil Alkaline Phosphatase, Tartarate Resistant Acid Phosphatase and Iron stain

4. Illustrate and interpret immunohistochemical stains on the trephine biopsy sample
5. Identify and interpret immunophenotyping results of peripheral blood and bone marrow in hematological malignancies

Assessment Tool

OSPE/DOPS/CBD

Course Outlines

The inherited BMF syndromes

Pancytopenia (usually associated with a global haemopoietic defect)

- Fanconi anaemia
  - Clinical features
  - Cell and molecular biology
  - Treatment
- Dyskeratosis congenita
  - Clinical features
  - Cell and molecular biology
  - Treatment
- Shwachman–Diamond syndrome
  - Clinical features
  - Cell and molecular biology
  - Treatment
- Reticular dysgenesis
  - Clinical features
  - Cell and molecular biology
  - Treatment
- Pearson syndrome
  - Clinical features
  - Cell and molecular biology
  - Treatment
- Familial aplastic anaemia (autosomal and X-linked forms)
- Myelodysplasia

- Non-haematological syndromes (Down, Dubowitz syndromes)

Single cytopenia (usually)

Anaemia

- Diamond–Blackfan anaemia
  - Clinical features
  - Cell and molecular biology
  - Treatment
- Congenital dyserythropoietic anaemia
  - CDA type I
  - CDA type II
  - CDA type III
  - Treatment

Neutropenia

- Severe congenital neutropenia including Kostmann syndrome

Thrombocytopenia

- Congenital amegakaryocytic thrombocytopenia
- Amegakaryocytic thrombocytopenia with absent radii

Acquired aplastic anaemia

- Definition
- Aetiology and incidence
- Pathogenesis and its clinical relevance
- Detection of somatic mutations in AA
- Diagnostic investigations and differential diagnosis
- Paroxysmal nocturnal haemoglobinuri

Haematological changes in systemic disorders

- Haematological problems in the elderly
- Haematological problems in the pregnancy & neonates
- Haematological problems in the renal disorders
- Haematological problems in the Liver disorders
- Haematological problems in the Hypothyroidism
- Haematological problems in the infections
- Haematological changes in osteopetrosis

Variations of Leukocytes in Disease

Abnormalities of the Neutrophils

- Neutropenia and neutrophilia
- Qualitative disorders of neutrophils

Abnormalities of the Eosinophils & Basophils

- Eosinopenia and Eosinophelia
- Basophilia

Abnormalities of the monocyte macrophage system

- The lysosomal storage diseases
- Gaucher disease
- Niemann Pick disease
- Fabry's disease

Abnormalities of the lymphocytes

- Langerhans cell histiocytosis
- Infectious mononucleosis

Disorders of the Spleen

- Structure and function of spleen
- Causes of splenomegaly
- Hematological findings in splenomegaly / Hypersplenism

Indications and complications of splenectomy

Practicals:

1. Acidified-serum lysis test (Ham test)
2. Sucrose lysis test
3. Flow cytometric analysis
4. Case slides/study of Bone marrow failure syndrome and WBCs benign disorders

Recommended Books

1. Bone Marrow Pathology 5th Edition by Barbara J. Bain
2. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
3. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
4. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
5. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
6. Robbins & Cotran Pathologic Basis of Disease 10th Edition by Vinay Kumar, Abul Abbas, Jon Aster10th Edition by Vinay Kumar, Abul Abbas, Jon Aster
7. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
8. de Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
11. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

Course title

Malignant White Blood cell disorders (Leukemias, Myelo & lymphoproliferative disorders, MDS, lymphomas {Hodgkin & non-Hodgkin) and Plasma cell dyscrasias)

Course code

HEM704

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)=	27		Theory	=	1.5
Practical (Clinical lab work)	=	81	Practical	=	1.5
Total	=	108	Total	=	3

Course objectives:

By the end of the course, students should be able to:

- Understand the genetic and environmental factors contributing to the development of acute and chronic leukemias.
- Explain the cellular and molecular mechanisms underlying leukemic transformation.
- Identify and explain the clinical features associated with Myelodysplastic Syndromes.
- Recognize the variability in presentation among different subtypes of MDS.
- Understand the underlying causes and mechanisms of Hodgkin and Non-Hodgkin Lymphomas.
- Differentiate between the pathophysiology of Hodgkin and Non-Hodgkin Lymphomas. Interpret results from laboratory tests, including bone marrow aspirate and biopsy, cytogenetic analysis, and flow cytometry for acute & chronic leukemias, Myeloproliferative disorders, MDS, Hodgkin and Non – Hodgkin Lymphomas.

Learning Outcomes

KNOWLEDGE

At the end of the course, the student will be able to

- Demonstrate the etiology, pathophysiology, clinical features, diagnostic criteria and laboratory investigations of acute and chronic leukemias.

- Demonstrate the etiology, pathophysiology, clinical features, diagnostic criteria and laboratory investigations of Myelodysplastic Syndromes.
- Illustrate the etiology, pathophysiology, clinical features, and laboratory investigations of Hodgkin and Non – Hodgkin Lymphomas

ASSESSMENT TOOL

MCQs/SEQs

CLINICAL SKILLS:

Students will

- Differentiate and analyze the test result of myeloprolefrative disorders
- Differentiate and analyze the test result of lymphoproliferative disorders
- Differentiate and analyze the test result of plasma cell dyscrasias
- Differentiate and analyze the test result of Myelodysplastic Syndromes
- Identify and interpret MPO, SBB, Periodic Acid-Schiff R (PAS)Acid Phosphatase, Leucocyte/Neutrophil Alkaline Phosphatase (LAP/NAP), Esterase and iron Staining test

ASSESSMENT TOOL

OSPE/DOPS/TOACS/CBD

Course Outlines:

Hematologic Malignancies

- General aspects
- Molecular genetics
- Complications

Classification and Differentiation of Acute Leukemias

- Acute Lymphoblastic Leukemia
- Clinical features
- Laboratory diagnosis
- Differential diagnosis
- Acute Myelogenous Leukemia
- Clinical presentation
- Classification
- Lab diagnosis including cytogenetics
- Special issues

The Myelodysplastic Syndromes

- Classification
- Pathogenesis and genetic features
- Clinical findings
- Laboratory diagnosis

Myeloproliferative Disorders

a) Chronic Myeloid Leukemia

- Clinical presentation and course
- Cellular and molecular pathogenesis
- Laboratory diagnosis

b) Polycytehmia Vera

- Clinical features
- Cytogenesis
- Pathogenesis
- Laboratory diagnosis

c) Myelofibrosis

- Etiology and pathogenesis
- Laboratory diagnosis
- Differential diagnosis
- Treatment

d) Essential Thrombocythemia

- Etiology and pathogenesis
- Laboratory diagnosis
- Cytogenetics
- Differential diagnosis

Lymphoproliferative Disorders

a) Chronic Lymphocytic Leukemia

- Etiology
- Clinical and laboratory findings
- Laboratory diagnosis
- Staging

b) Hairy Cell Leukemia

c) Non – Hodgkin Lymphomas

- Etiology and cytogenetic studies
- Classification
- Morphology
- Clinical features
- Prognostic factors

d) Hodgkin Disease

- Etiology and pathogenesis
- Clinical features
- Classifications
- Staging

e) Cutaneous T cell Lymphoma; Mycosis Fungoides and Sezary Syndrome

Plasma Cell Dyscrasias

General Considerations

a) Multiple Myeloma

- Etiology , cytogenetics and pathogenesis
- Clinical manifestations
- Laboratory diagnosis

b) Waldenstrom Macroglobulinemia

c) Heavy Chain Disease

- Clinical features
- Lab diagnosis

d) Amyloidosis

- Physical and chemical nature of amyloid fibrils
- Pathogenesis
- Clinical findings
- Laboratory diagnosis

e) Cryoglobulin and cryoglobulinemia

- Classification
- Clinical findings
- Laboratory diagnosis

Practicals:
MPO, SBB, Periodic Acid-Schiff R (PAS), Acid Phosphatase, Leucocyte/Neutrophil Alkaline Phosphatase (LAP/NAP), Esterases and iron Staining

Recommended Books

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
3. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
4. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
5. Robbins & Cotran Pathologic Basis of Disease 10th Edition by Vinay Kumar, Abul Abbas, Jon Aster10th Edition by Vinay Kumar, Abul Abbas, Jon Aster
6. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
7. Bone Marrow Pathology 5th Edition by Barbara J. Bain

8. de Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
11. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

Course Title

Platelets & Coagulation Disorders

Course code

HEM705

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)=	27		Theory	=	1.5
Practical (Clinical lab work)	=	54	Practical	=	1
Total	=	81	Total	=	2.5

Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

1. Demonstrate the basic knowledge of Megakaryopoiesis
2. Demonstrate knowledge about the aetiology, pathophysiology, clinical features and laboratory investigations of:
    a. Heriditory Coagulation disorders
    b. Platelet disorders
    c. von Willebrand Disease
    d. Fibrinolytic Disorders
    e. Clotting Factors disorders and their Inhibitors
    f. Acquired Coagulation Disorders
    g. Coagulation defects in Liver and kidney disease
    h. Vitamin K deficiency
3. Illustrate the etiology, pathophysiology, diagnosis and management of arterial and venus Thrombosis (thrombophilia), Heparin-Induced Thrombocytopenia, Lupus Anticoagulants, Antiphospholipid Antibodies, and Antiphospholipid Syndrome
4. Able to interpret thrombophilia results in pregnancy, on the oral contraceptive pill, hormone replacement therapy and in patients on anticoagulant therapy

5. Apply important clinical concepts and principles to draw conclusions about Anticoagulant, Antiplatelet, and Thrombolytic Drugs

ASSESSMENT TOOL

MCQs/SEQs

CLINICAL SKILLS:

Students will

1. Identify and explain the following laboratory tests
    a. Bleeding time
    b. Prothrombin time
    c. Activated Partial Thromboplastin Time
    d. Thrombin Time
    e. Fibrinogen level
    f. D dimers and Fibrinogen Degradation Products
    g. Mixing studies
    h. Factor assays
    i. Platelet function studies
    j. Urea lysis test
    k. Thrombophilia screening
    l. Lupus anticoagulant testing
    m. Factor V leiden assay
    n. Factor inhibitors
2. Use specified methods of enquiry and competence in taking sample collection and processing in Hemostasis
3. Demonstrate knowledge about the significance of taking history and an examination of a bleeding patient
4. Identify and explain the guidelines for Evaluation of Coagulation Analyzers and Coagulation Testing
5. Explain the Point-of-Care Testing in Hemostasis

ASSESSMENT TOOL

OSPE/DOPS/TOACS/CBD

Course contents

Platelets and Megakaryocytes

- Megakaryocytes
- Platelet formation and release
- Platelet structural and functional anatomy
- Platelet physiology
- Platelet function
    - Platelet adhesion
    - Platelet aggregation

    - Platelet release reaction
    - Pathologic role of platelets in hemostasis and thrombosis
- Platelet antigens

Blood Coagulation And Fibrinolysis

- Normal coagulation cascade
- Clotting factors
    - Structure and function of all factors
- Natural inhibitors of coagulation system
    - Protein C and protein S pathway
    - Anticoagulant proteins
    - Alpha2 macrogloblin, serine protease inhibitors, Anti thrombin III,
    - Protein C inhibitor
    - Heparin Co factor II
    - Tissue factor pathway inhibitor
    - Fibrinolytic system
    - Inhibitors of fibrinolytic system
    - Physiologic regulation of fibrinolysis
- Role of fibrinolytic process in preventing thrombosis

Endothelium and Regulation Of Hemostasis

- Endothelial cell structure
- Anti-thrombotic properties of endothelium
- Pro-thrombotic properties of endothelium

Disorders of Hemostasis and coagulation

Diagnostic Approach to the Bleeding Disorders

- Clinical evaluation of the bleeding patient
- Laboratory methods for the study of hemostasis and blood coagulation.
- Bleeding and coagulation time
- PT and APTT
- Factor assays
- Tests for inhibitors of coagulation

Bleeding Disorders Caused By Vascular Abnormalities

- Classification
- Pathophysiology

Thrombocytopenia

- Classification
- Causes of thrombocytopenia
- Pathophysiology of immunological platelet destruction
- Thrombotic thrombocytopenic purpura
- Other forms of non-immunologic platelet destruction

Thrombocytosis

Qualitative Disorders Of Platelet Function

- Bernard Soulier syndrome
- Glanzmann's thrombasthenia
- Storage pool disease
- Abnormal platelet mechanism
- Acquired disorder of platelet function

Inherited Coagulation Disorders

- Hemophilia A
- Von Willebrand's disease
- Hemophilia B
- Factor XIII deficiency
- Prothrombin deficiency
- Factor V deficiency
- Factor VII deficiency
- Factor X deficiency
- Factor XI and XII deficiency
- Pre kallikarein deficiency

Acquired Coagulation Disorders

- Deficiency of vitamin k dependent factors
- Liver disease
- Disseminated intravascular coagulation
- Primary fibrinolysis
- Pathologic inhibitors of coagulation

Thrombosis and Anti Thrombotic Drugs

- Pathophysiology of thrombosis
- Inherited thrombotic disorders
- Anti-thrombotic drugs
- Laboratory evaluation & monitoring of anticoagulant therapy

Practicals:

- Bleeding, coagulation time and PFA 100
- PT and APTT
- Mixing study
- Factor assays
- Platelet aggregation study
- Tests for inhibitors of coagulation

Recommended Book:

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta

3. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
4. Haemoglobinopathy Diagnosis, 3rd Edition by Barbara J. Bain
5. Robbins & Cotran Pathologic Basis of Disease 10th Edition by Vinay Kumar, Abul Abbas, Jon Aster10th Edition by Vinay Kumar, Abul Abbas, Jon Aster
6. Blood Cells A Practical Guide 3rd Edition by Barbara J. Bain
7. Bone Marrow Pathology 5th Edition by Barbara J. Bain
8. de Gruchy's Clinical Haematology in Medical Practice, 5th Edition by Frank Firkin, C. Chesterman, D. Penington, B. Rush
9. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp
10. Tietz Applied Laboratory Medicine 2nd Edition by Mitchell G Scott
11. Henry's Clinical Diagnosis and Management by Laboratory Methods 24th by Richard A Mcpherson

Course title

Laboratory Quality Assurance and Management

Course code

HEM706

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)	=	27	Theory	=	1.5
Practical (Clinical lab work)	=	54	Practical	=	1
Total	=	81	Total	=	2.5

Course objectives:

By the end of the course, students should be able to:

- Articulate clear definitions of Quality Assurance and Quality Control in the context of laboratory operations.
- Explain the roles of Quality Assurance and Quality Control in ensuring accurate and reliable laboratory results.
- Describe pre-analytical, analytical, and post-analytical phases of laboratory testing.
- Identify common variables and potential sources of error in each phase.
- Define proficiency testing and understand its significance in assessing laboratory performance.
- Recognize the role of proficiency testing in maintaining and improving laboratory quality.
- Identify external quality control measures and their importance in laboratory quality assurance.
- Explain the processes involved in external quality control programs.

- Discuss the significance of quality standards, models, and awards such as ISO, TQM, Malcolm Baldrige, and EFQM in laboratory quality management.
- Understand the benefits and implications of adhering to these quality frameworks.

Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

- Define and Explain Quality Assurance Quality Control
- Explain and identify Pre-analytical, analytical and post analytical variables
- Define proficiency testing
- Identify and explain external quality control
- Discuss the importance of quality standards, models and awards (ISO, TQM, Malcolm Baldrige, EFQM etc.)

ASSESSMENT TOOLS

MCQs/SEQs

Clinical Skills:

Students will be able to

- Analyse and identify inventory management
- Explain the communication skills with lab staff, patients, administration and vendors
- Discuss the implementation of policies and SOPs
- Analyze optical techniques, electrochemistry, electrophoresis and Lab Automation including centrifuge, water bath, analytical balance, automated Hematology analyzers, spectrophotometer

Assessment Tool

MCQs/SEQs

Corse Outlines:

Quality control in Haematology and blood bank

Internal quality control measures

- External quality assessment
- Quality Assurance

Pre-analytical, Analytical and Post-analytical Components

- Proficiency Testing
- Establishment of Quality Control Limits
- Interpretation of Quality Control Charts

- Bulls Testing Algorithm
- Monitoring QC with Patient Specimens
- Detection of abnormal Test Results And Delta Checks

Instrument validation

Quality standards, models and awards (ISO, TQM, Malcolm Baldrige, EFQM etc.)

Implementation of policies and SOPs

Recommended Books

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Quality Assurance in Haematology by S. M. Lewis (Author), R. L. Verwilghen (Editor)
3. Automation and Quality Assurance in Haematology Textbook Binding by R.M. Rowan (Author), J.M. England (Author
4. Handbook of Hematologic Pathology 1st Edition By Harold Schumacher, William Rock, Sanford Stass
5. Effective Processes for Quality Assurance 1st Edition By Boyd L. Summers

Course Title

Transfusion Medicine

Course code

HEM707

Contact Hours:			**Credit Hours:**		
Theory (Face to face teaching)=	18		Theory	=	1
Practical (Clinical lab work)	=	54	Practical	=	1
Total	=	72	Total	=	2

Course Objectives:

By the end of the course, students should be able to:

These course objectives are designed to equip students with a thorough understanding of immunohematology, blood transfusion, and related topics, encompassing both theoretical knowledge and practical skills essential for safe and effective blood component processing and transfusion practices.

Learning outcomes

KNOWLEDGE

At the end of the course, the student will be able to

1. Illustrate the structure of immunoglobulin, genetic basis for antibody diversity, red cell alloantibodies and autoantibodies, Factors influencing antigen antibody reactions, Natural and acquired antibodies, Mechanisms of red cell sensitization, complement activation, blood product anticoagulants and preservatives.
2. Describe and explain the biochemistry, genetic inheritance, immunogenicity and clinical significance of Carbohydrate (ABO, Lewis, P, I/i) and Protein (Kell, Kidd, Duffy, MNS and others) red cell antigens
3. Identify and summarized the significance of disease associations with the null phenotypes of ABO, Rh and Kell
4. Identify and explain the types of blood donors and strategies to recruit voluntary blood donors
5. Analyze and explain the preparation and quality control of blood components
6. Demonstrate the indication, preparation and contraindication of Plateletpheresis, Leucapheresis/Plasmapheresis
7. Illustrate the complications of blood transfusion
8. Identify and explain the Hemolytic disease of the newborn
9. Identify and explain the indication & contraindication of component therapy in different disorders and special transfusion Circumstances such as pregnancy, neonates, transplant patients
10. Illustrate the Leukoreduction (indications and methods) and Emergency transfusion protocols

ASSESSMENT TOOLS

MCQs, SEQs

CLINICAL SKILLS:

Students will be able to

1. Identify serologic testing by different methods – Tube, gel, solid phase and microplates
2. Analyze the methods of Weak D testing, antibody screening and identification, cross matching, enhancement techniques, adsorption/elution techniques, Donath Landsteiner test and antibody titration tests
3. Identify and explain the investigation of blood transfusion reactions
4. Carry out the use of pediatric blood bags, sterile connecting devices, irradiation of red cell and platelet concentrates, leucodepleted blood products and leucocyte concentrate
5. Analyze the investigation of possible transfusion-transmitted infections
6. Monitor quality control of blood grouping, Coomb's antisera and blood products & Dispose of blood components
7. Use specified methods of Apheresis
8. Analyzing the serologic investigation of Immune hemolytic anemia

ASSESSMENT TOOL

OSPE/DOPS/CBD

Course Outlines:

Transfusion of blood and blood components

- Donor selection
- Blood donation and collection
- Collection process
- Red cell preservation
- Anticoagulants
- Components and fractionation of blood
- Blood components
- Plasma fractionation products
- Frozen RBC
- Autologous blood transfusion
- Indications of blood transfusion
- Exchange transfusion

Platelet Transfusion

- Indications of platelet transfusion
- Selection of platelet donors
- Preparation of platelet concentrates
- Platelet storage
- Frozen platelet

Granulocyte Transfusion

- Indications
- Selection of donors
- Preparation of granulocytes for transfusion
- Storage
- Dosage
- Adverse effects

Transfusion of Plasma And Plasma Derivatives.

- Fresh frozen plasma
- Anti-hemophilic factor
- Factor concentrates
- Albumin
- Immunoglobulin preparation- indications and dosage

Adverse Effects Of Blood Transfusion

- Immunologic reactions
- Non immunologic reactions
- Infectious complications (diseases transmitted)
    - Hepatitis B,C,D,A,E
    - HIV, Cytomegalovirus, EB Virus
    - Malaria and other parasitic infection

Therapeutic Aphaeresis

Hemopoietic Stem Cell Transplantation

- Hemopoietic stem cells
- Sources
- Indications
- Engraftment
- Complications
- Graft versus host disease
- Infectious diseases

Practicals:

Blood grouping

Cross match

Recommended Books

1. Dacie and Lewis Practical Haematology, 12th Edition by Barbara J. Bain & Imelda Bates & Mike A Laffan
2. Modern Blood Banking & Transfusion Practices, 7th by Denise M. Harmening
3. Postgraduate Haematology, 8th Edition by A. Victor Hoffbrand, Douglas R. Higgs, David M. Keeling, Atul B. Mehta
4. AABB Technical Manual of Blood Banking 20th Edition
5. Basic & Applied Concepts of Blood Banking and Transfusion Practices, 5th Edition by Paula R. Howard, MS, MPH, MT(ASCP)SBB
6. Hoffbrand's Essential Haematology 8th Edition by A. Victor Hoffbrand, David P. Steensma
7. Handbook of Haematology and Blood Transfusion Technique J.W. Delancy and G.Garralty
8. Manual of Laboratory Medicine Armed Forces Institute of Pathology Rwp

Course Title: Professional & Teaching Skills Apprenticeship (PTSA)

Credit Hours:02

Professional Skills Apprenticeship credit hours: 01

Teaching Skills Apprenticeship credit hours (CMT): 01

Professional Skills Apprenticeship:

Learning outcomes

ASSESSMENT TOOLS

MCQs, SEQs

CLINICAL SKILLS:

Students will be able to

1. Identify and analyze laboratory findings of anemia
2. Identify and analyze laboratory findings of Leukemia, lymphomas and plasma cell dyscrasias
3. Identify and analyze coagulation disorders
4. Identify and analyze blood grouping & cross match
5. Identify and analyze peripheral smear morphology
6. Identify and analyze bone marrow aspiration morphology
7. Identify and analyze trephine biopsy morphology

ASSESSMENT TOOL

OSPE/DOPS/CBD

Course Outlines:

Hb estimation

Red cell count (automated & Manual)

White cell count (automated & Manual)

Platelet count (automated & Manual)

Iron studies

CBC analyzer

Iron stain

Reticulocyte stain

Hb electrophoresis

HPLC

SBB

MPO

PAS

Esterases (specific &non-specific)

Reticulin stain

Blood grouping

Cross match

Bone marrow aspiration & trephine

Teaching Skills Apprenticeship

All students of M Phil programme will get registered for the CMT Certification in the final semester. Completing the course work and successfully getting certified for CMT, which is a patent of UHS, will be a compulsory integral component of PTSA (Professional and Teaching Skills Apprenticeship) for the 4th semester of all M Phil programs at UHS.