



## BLOOD & IMMUNOLOGY - II MODULE

3<sup>RD</sup> YEAR MBBS

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**Khyber Medical University (KMU) Vision:**

Khyber Medical University will be the global leader in health sciences academics and research for efficient and compassionate health care.

**Khyber Medical University (KMU) Mission:**

Khyber Medical University aims to promote professional competence through learning and innovation for providing comprehensive quality health care to the nation.

**Institute of Health Professions Education & Research (IHPER) Mission:**

To produce leaders, innovators and researchers in health professions education who can apply global knowledge to resolve local issues.

# Teaching Hours Allocation

Table 1 Hours Allocation

S. No	Subject	Hours needed
1	Pathology	30
2	Pharmacology	7
3	Forensic medicine	9
4	Community medicine	9
5	Medicine	3
6	Physiology	3
7	Pediatrics	1
8	PRIME/Medical Education and Research	2+1
	<b>Total</b>	<b>65</b>

## Themes

Themes	Duration in weeks
Pallor and Fatigue	1 week
Fever	1 week
Bleeding	1 week

# Learning Objectives

**By the end of Blood & Immunology II Module, 3rd year MBBS students will be able to:**

1. Describe the pathophysiology and diagnosis of different types of anemia.
2. Explain the pathogenesis of different hematological malignancies.
3. Discuss the diagnostic approach to malignant hematological disorders.
4. Discuss the pathophysiology and diagnosis of bleeding disorders.
5. Explain the immune system of the body and its components.
6. Describe the mechanism of defense from infection.
7. Explain hypersensitivity and allergy.
8. Discuss the rationale for immunomodulation and its impact on improving the therapeutic dynamics of autoimmune disorders and malignancies.
9. Describe the drugs for treating various types of anemia.
10. Write prescription for the prevention and treatment of iron-deficiency anemia.
11. Describe the application of blood groups in Forensic work
12. Describe the examination of blood stains
13. Describe the medico legal importance of blood as trace evidence
14. Describe the EPI schedule of Pakistan and the basic principles of Immunization.
15. Describe the most prevalent anemia's that affect the population of Pakistan, and the risk factors for vulnerable population.
16. Describe the most prevalent blood borne infections that affect the population of Pakistan, and the appropriate preventive strategies including safe blood practice.

Theme 1: Pallor and Fatigue		
Subject	Topic	Learning objectives
Physiology	Red blood cells	Discuss the steps of erythropoiesis with Correlation to red cell indices and its clinical implications.
Pathology	Anemia	Discuss physiologic basis of anemia.
		Classify anemia's according to underlying Mechanism
	Blood loss	Describe the pathogenesis of blood loss Anemia
	Hereditary Spherocytosis	Discuss the pathogenesis of Hereditary Spherocytosis
		Describe morphological changes in peripheral Smear of HS patient
		Explain how will you diagnose a case of HS?
	Sickle cell Anemia	Discuss the morphology of rbcs in Sickle cell Anemia
		Describe the etiology and pathogenesis in SA
		Explain how will you diagnose a case of SA?
	Thalassemia	Describe Thalassemia
		Discuss the conditions contributing to the Pathogenesis of beta- thalassemia
		Explain the genetics of thalassemia
		Describe the morphological changes physically And on peripheral smear
		Explain how will you diagnose a case of alpha Or beta thalassemia?
Glucose 6 phosphate dehydrogenase	Classify G6PD	
	Discuss the pathogenesis of G6PD with Reference to oxidative injury of rbcs	

	deficiency	Describe the morphology of rbc's in G6PD
		Explain how will you diagnose a case of G6PD Deficiency
	Paroxysmal Nocturnal Hemoglobinuria	Describe the pathophysiology of Paroxysmal Nocturnal Hemoglobinuria
		Explain the diagnosis of a case of PNH?
	Immune hemolytic anemia's	Classify immune hemolytic anemia's
		Discuss the etiological mechanism of warm and cold antibody immune hemolytic anemia
Explain the diagnostic workup of immune Hemolytic anemia		
	Iron deficiency anemia	Discuss the pathophysiological mechanism of Iron deficiency anemia
		Describe the clinical course and morphological changes in IDA
		Explain laboratory investigations for the diagnosis of IDA
	Megaloblastic Anemia	Describe Megaloblastic Anemia
		Describe the pathogenesis of MA with respect to Vitamin B12 and Folic acid
		Discuss the morphological changes in RBCs, WBCs and platelets in MA.
		Explain how will you diagnose the cause of MA?
	Aplastic Anemia	Enumerate causes of Aplastic anemia
		Describe the pathophysiology of aplastic anemia
		Diagnose a case of aplastic anemia
	polycythemia vera	Discuss the pathophysiology of polycythemia vera
		Describe the clinical course and morphological features of Polycythemia vera
Explain how will you diagnose a case of Polycythemia vera?		
<b>PHARMACOLOG Y</b>	Drugs used in anemia	Classify the drugs used in anemia
		Describe pharmacokinetics of Iron
		Describe the various oral and parenteral formulations of iron
		Describe the adverse effects of iron therapy
		Describe the drug treatment of Iron toxicity



		Describe the various oral and parenteral preparations of cyanocobalamin (Vit B12)
		Describe the clinical use of cyanocobalamin (Vit: B12)
		Describe the clinical use of Folic acid
		Describe the pharmacological rationale of combining cyanocobalamin with folic acid and iron
		Describe the role of granulocyte colony stimulating factors (Filgrastim) and granulocyte monocyte colony stimulating factors in the treatment of leucopenia.
		Describe the role of thrombocyte colony stimulating factor (Oprelvekin) in the treatment of thrombocytopenia.
<b>FORENSIC MEDICINE</b>	<b>FORENSIC EVIDENCE</b>	Describe trace evidence
		Classify trace evidence.
		Describe Locard's exchange principle.
		Describe composition of blood and characteristics of different blood cells.
	Describe basic genetic principles related to blood groups and blood groups as hereditary factors.	
	<b>BLOOD GROUP SYSTEMS</b>	Describe different blood groups systems. <ul style="list-style-type: none"> <li>▪ Grouping based on red cell antigens</li> <li>▪ Grouping based on blood proteins</li> <li>▪ Grouping based on enzymes</li> <li>▪ Grouping based on white cell antigens.</li> <li>▪ Describe different methods for blood group determination.</li> <li>▪ Direct agglutination</li> <li>▪ Ring test</li> <li>▪ Gel diffusion</li> <li>▪ Immune-electrophoresis</li> <li>▪ Indirect agglutination</li> </ul>

		Describe the application of blood in forensic work. (medico legal importance) <ul style="list-style-type: none"> <li>▪ Inheritance claims</li> <li>▪ Rh hazards</li> <li>▪ Transfusion errors and adverse reactions</li> <li>▪ DNA profiling</li> <li>▪ Disputed paternity and maternity</li> </ul>
<b>COMMUNITY MEDICINE</b>	Epidemiology of nutritional anemias	Classify nutritional anemias
		Describe the population at risk of nutritional anemia in Pakistan.
		Explain effective public health strategies for prevention of nutritional anemias in in Pakistan
		Describe risk factors for different nutritional anemia's.
		Describe effective public health strategies for prevention of different types of anemia's in Pakistan
<b>PAEDIATRICS</b>	Thalassemia	Describe Classification, Laboratory Investigation and management of Thalassemia
<b>MEDICINE</b>	Sickle Cell Anemia	Discuss the pathophysiology, investigations and management of Sickle Cell Anemia.

## Theme 2: Fever

Subject	Topic	Learning objectives
Physiology	White blood cells	Classify the different types of white blood cells, Polymorph's, Lymphocytes and Plasma cells and their disorders.
Pathology	Acute myelogenous leukemia	Classify acute myelogenous leukemias according to FAB.
		Discuss the pathophysiology of AML.
		Describe the morphological features of AML.
		Explain how will you proceed for diagnosis of AML?
	Chronic myelogenous leukemia	Discuss the pathophysiology of CML.
		Describe the peripheral blood findings in CML
		Explain how will you proceed for diagnosis of CML?
	Myelodysplastic syndrome (mds)	Enlist types of MDS.
		Discuss causes, pathogenesis and Morphology.
		Interpret blood and bone marrow changes in patient with MDS.
		Discuss symptoms and diagnostic strategies for patient with MDS.
	Lymphoid neoplasms	Enumerate Lymphoid neoplasm
		Classify lymphoid neoplasms according to WHO classification.
	Acute lymphocytic leukemia	Discuss the pathophysiology of Acute lymphocytic leukemia
		Discuss the morphological features of ALL
		Explain how will you diagnose a case of ALL?
	Chronic lymphocytic leukemia	Discuss the pathophysiology of Chronic lymphocytic leukemia
		Describe the distinguishing morphological features of CLL
Explain the diagnostic workup for a case of CLL		
Plasma cell disorder	Describe the pathogenesis of multiple myeloma	
	Describe the molecular genetics involved in multiple myeloma	
Hodgkin' s lymphoma	Discuss the type of multiple myeloma	
	Enlist the clinical features	
	Classify Hodgkin's lymphoma	
	Discuss the etiology and pathogenesis of Hodgkin's lymphoma	

	Describe the morphological changes and clinical course of the disease in Hodgkin's Lymphoma
Non-hodgkin' s lymphoma	Enlist Non-Hodgkin's lymphoma
	Describe the basic pathologic classification of NHL (the WHO classification).
	Describe the predisposing factors to developing NHL, including infectious agents associated with development of specific lymphomas.
	Describe the morphologic features of lymph nodes involved in Non-Hodgkin Lymphoma
	Enlist the lab investigations required for diagnosis of NHL
Immunity	Describe the functions and types of immunity.
	Enlist the three lines of defenses and outline their properties
	Describe the characteristics, origin and functions of cells of immune system
	Compare innate and acquired immunity
	Compare the mechanism of active and passive immunity
Humeral immunity	Describe the role of T and B lymphocytes in immunity
	Describe the role of B lymphocytes in humeral immunity
	Describe humeral immunity
	Explain how helper T cells regulate the immune system
	Differentiate between humeral and cell mediated immunity
Cell mediated immunity	Explain the Specificity of immune response
	Describe cell mediated components of Cell mediated immunity (CMI),
	Explain types of cells in CMI system
	Describe T-cell activation and diversity
Antibodies	Illustrate Schematic representation of T cell activation and diversity
	Differentiate between Primary and secondary immune response
	Describe antigen and antibodies.
	Differentiate B/W Monoclonal and polyclonal antibodies.
	Classify immunoglobulin
	Illustrate structure (diagram) of immunoglobulin A.
	Describe important functions of immunoglobulin
	Explain How antibodies neutralize toxins, microbes and viruses

		Illustrate class switching of immunoglobulin
		Explain transfer of immunity from mother to fetus and from mother to infant during breast-feeding
Allergy & hypersensitivity		Describe the pathophysiology of allergy and hypersensitivity with examples
		Compare immediate and delayed hypersensitivity reactions
		Enlist the diseases associated with hypersensitivity reactions
Immune tolerance		Describe Immunotolerance.
		Describe Immunological unresponsiveness of the body especially to self-antigens.
		Explain the role of immune system in protecting the human body.
		Distinguishing between types of immunotolerance
		Explain the mechanism of graft rejection and graft vs host disease.
Autoimmune diseases		Describe Autoimmunity.
		Discuss Pathogenesis of Autoimmune diseases.
		Explain the factors leading to Autoimmune Diseases.
Immunodeficiency diseases		Describe immunodeficiency
		Differentiate between Autoimmune and immunodeficiency diseases.
		Classify Congenital and acquired Immunodeficiency diseases.
		Describe the pathogenesis of HIV.
COMPLEMENT		Describe complement.
		Describe components of the Complement System
		Describe the synthesis of complements
		Describe pathways of activation and inactivation of complement
		Describe important functions of each component of complement system
		Describe the diseases associated with deficiency of the complement proteins
PHARMACOLOG Y	Immune modulator drugs	Classify immunomodulating drugs
		Describe the role of corticosteroids as immunosuppressant agents.
		Describe mechanism of action of immunophilin ligands.
		Describe clinical uses and adverse effects of immunophilin ligands.

		Describe mechanism of action of enzyme inhibitors.
		Describe clinical uses and adverse effects of enzyme inhibitors.
		Describe mechanism of action of cytotoxic agents as immunosuppressant
		Describe clinical uses and adverse effects of cytotoxic agents
		Describe mechanism of action of immunosuppressive antibodies used as immunosuppressant
		Describe clinical uses and adverse effects of immunosuppressive antibodies
		Describe mechanism of action of monoclonal antibodies
		Describe clinical uses and adverse effects of monoclonal antibodies
		Describe mechanism of action of immunostimulant drugs
		Describe clinical uses and adverse effects of immunostimulant drugs
		Describe the advantages and disadvantages of various combinations of Immuno-modulating drugs
		Describe Forensic Lab Systems
Prime/research	Academic writing and plagiarism	Emphasize the role of academic writing in research
		Explain the role of “Grammarly” for use in academic writing
		Define plagiarism
		Enlist plagiarism detection software
<b>Forensic medicine</b>	Forensic Lab Procedures	<p>Describe Forensic Lab Procedures</p> <ul style="list-style-type: none"> <li>· Forensic histopathology</li> <li>· Naked eye examination</li> <li>· Histological examination</li> <li>· Forensic histochemistry</li> <li>· Steam distillation</li> <li>· Micro-diffusion analysis</li> <li>· Stas-Otto method</li> <li>· Colour reaction method</li> <li>· Chromatography</li> <li>· Spectroscopy</li> <li>· Electrophoresis</li> <li>· Radio-activation technique</li> </ul>

<b>Community medicine</b>	Immunization	Detection of insecticide compounds
		Define immunity
		Explain the types of immunity
		Discuss immunizing agents
		Explain the hazards of immunization
	Vaccination	Explain the cold chain in the context of immunization
		Explain the importance of vaccination in the control of infectious diseases
		Describe the basic principles of vaccination
		List the main types of vaccine and illustrate them with examples
		Describe vaccines that are associated with adverse reactions
		Explain the difference between live attenuated and inactivated vaccines
		Describe the role of vaccines in preventing disease.
		Differentiate between vaccination and immunization
		Describe the strategies used from community medicine's perspective to promote vaccination in communities. (EPI)
		Explain various programs of vaccination in Pakistan with particular reference to EPI.
	Describe the factors responsible for success and failure of vaccination programs in Pakistan.	
	Epidemiology of blood borne diseases/infections	List the important blood borne diseases in Pakistan as prioritized by the National Institute of health (NIH)
		Discuss the global burden of blood borne diseases & compare with Pakistan
		Describe important blood borne pathogens
Explain the evidence based public health practices to reduce transmission of blood borne infectious disease		
Explain the evidence based best practices and procedures for safe blood transfusion and prevention of needle stick injury		
<b>MEDICINE</b>	Myeloproliferative Disorders (MPN)	Classify myeloproliferative neoplasms.
		Discuss the investigations & management steps of CML.

### Theme 3: Bleeding

Subject	Topic	Learning objectives	
Physiology	Platelets	Enumerate the causes of thrombocytopenia.	
		Explain the intrinsic and extrinsic pathways of Coagulation	
Pathology	Thrombocytopenia & von willebrand disease	Enlist causes of Thrombocytopenia	
		Describe the pathogenesis of immune thrombocytopenic purpura	
		List thrombotic microangiopathies	
		Explain the diagnostic plan for ITP	
		Classify VWD	
		Enlist investigations required for diagnosis of VWD	
	Hemophilia	Hemophilia	Discuss the pathogenesis of hemophilia A and B
			Describe the clinical course of the disease.
			Enlist the laboratory investigation for diagnosing a case of hemophilia
	Disseminated intravascular coagulopathy	Disseminated intravascular coagulopathy	Enlist major disorders associated with DIS
			Discuss the pathophysiology of DIC
			Explain the morphological changes in DIC
			Explain how will you diagnose DIC?
	Transfusion medicine	Transfusion medicine	Describe various blood component preparation
			Identify indications for different blood components
			Describe transfusion reactions associated with blood transfusion
Pharmacology	Anti-plasmin (antifibrinolytic) drugs	Describe mechanism of action of Anti- plasmin (antifibrinolytic) drugs	
		Describe clinical uses and adverse effects of Anti-plasmin (antifibrinolytic) drugs	
	Drug treatment of Haemophilia	Drug treatment of Haemophilia	Describe the drug treatment for various types of Haemophilia
			Describe the role of Desmopressin in the treatment of haemophilia



<b>Forensic medicine</b>	Blood stains	Describe examination of blood stains. <ul style="list-style-type: none"> <li>· Physical examination</li> <li>· Chemical examination</li> <li>· Physicochemical examination</li> <li>· Micro chemical examination</li> <li>· Spectroscopic examination</li> <li>· Immunological and enzymological methods for species determination</li> </ul>
		Describe the medico legal importance of blood stains.
	Collection And Preservation Of Biological Material	Describe the collection and preservation of biological material <ul style="list-style-type: none"> <li>· Blood</li> <li>· Swabs and smears</li> <li>· Saliva</li> <li>· Semen</li> </ul>
<b>Medicine</b>	Platelets (itp)	Describe Clinical features, investigations and management of a patient with Immune Thrombocytopenia (ITP).
<b>PRIME/Medical education</b>	Principles of medical ethics	Explain the pillars of medical ethics
		Explain the privacy and confidentiality of the patients and its medico-legal and cultural aspects
	Confidentiality	Exhibit Confidentiality of colleagues and patients
Appropriately use of social media		

Practical Work		
Subject	Topic	Learning objectives
		<b>Theme 1</b>
Pathology	Normal complete Blood count	Differentiate between a normal blood cells of different lineages
	ABNORMAL PERIPHERAL SMEAR IN DIFFERENT ANEMIAS	Differentiate between a normal and an abnormal RBC
		Identify different shapes of RBCs.
		Identify the common types of Anemia on the basis of RBC morphology
Pharmacology	Iron- deficiency anemia	Write prescription for a patient at risk of developing iron-deficiency anemia
		Write Chart order for treating an in-door patient with iron-deficiency anemia
Field visit	Visit to blood bank of a tertiary care hospital	Explain safe blood transfusion practices
		List the common pathogens that cause blood borne infections which may be acquired from unsafe blood transfusion practices.
		List the most common transfusion reactions seen in a blood bank in a local teaching hospital in Pakistan
		Communicate with health care staff effectively
		Describe the standard operating procedures (SOP's) of blood transfusion
Pathology	Normal white cell smear	Describe causes of leukocytosis
		Differentiate different types of white blood cells under microscope
Forensic medicine	Microscopic examination of animal and human blood	Perform Microscopic examination of animal and human blood.

	Examination of blood stains under ultraviolet light	Perform examination of blood stains under ultraviolet light.
	Different pattern of stains	Identify different pattern of stains.
<b>Field visit</b>	Visit to basic health care unit EPI Center	Observe administration of different vaccines as part of Expanded Program of immunization (EPI) schedule of Pakistan at the vaccination center.
		List and explain the route of administration and mechanism of storage and maintenance of cold chain of each vaccine in the EPI schedule (support with images where possible)
		List the different components of each vaccine in the EPI schedule including the adjuvants, preservatives and explain their relevance to the vaccine.
		Differentiate between live attenuated vaccines, conjugate vaccines, subunit vaccines, and toxoid vaccines in the EPI schedule and their mode of action
		Identify the contraindications for vaccination that may present an additional risk
		Describe the organization of EPI center
		Explain the role of EPI center.
		Observe the process of vaccination on a case.
<b>Pathology</b>	Coagulation tests	Interpret Prothrombin time and activated partial thromboplastin time
		Interpret bleeding time and clotting time

## Learning Resources

S#	Subjects	Textbooks
1.	Community Medicine	1. Community Medicine by Parikh 2. Community Medicine by M Illyas 3. Basic Statistics for the Health Sciences by Jan W Kuzma
2.	Forensic Medicine	1. Nasib R. Awan. Principles and practice of Forensic Medicine 1st ed. 2002. 2. Parikh, C.K. Parikh's Textbook of Medical Jurisprudence, Forensic Medicine and Toxicology. 7th ed. 2005. 3. Knight B. Simpson's Forensic Medicine. 11th ed. 1993. 4. Knight and Pekka. Principles of forensic medicine. 3rd ed. 2004 5. Krishan VIJ. Text book of forensic medicine and toxicology (principles and practice). 4th ed. 2007 6. Dikshit P.C. Text book of forensic medicine and toxicology. 1st ed. 2010 7. Polson. Polson's Essential of Forensic Medicine. 4th edition. 2010. 8. Rao. Atlas of Forensic Medicine (latest edition). 9. Rao. Practical Forensic Medicine 3rd ed ,2007. 10. Knight: Jimpson's Forensic Medicine 10th 1991, 11th ed. 1993 11. Taylor's Principles and Practice of Medical Jurisprudence. 15th ed. 1999
3.	Pathology	1. Robbins & Cotran, Pathologic Basis of Disease, 9th edition. 2. Rapid Review Pathology, 4th edition by Edward F. Goljan MD
4.	PHARMACOLOGY	1. Lippincott Illustrated Pharmacology 2. Basic and Clinical Pharmacology by Katzung

# Assessment Plan - 3rd Year MBBS

The year-3 will be assessed in 3 blocks

- 1) Block-1 (Foundation 2 and Infection and Inflammation modules) will be assessed in paper-G
- 2) Block-2 (Multisystem, blood and MSK modules) will be assessed in paper-H
- 3) Block-3 (CVS and Respiratory module) will be assessed in paper-I
- 4) Each written paper consists of 120 MCQs and
- 5) Internal assessment will be added to final marks in KMU as shown in below table.
- 6) In OSPE, each station will be allotted 6 marks, and a total of 120 (+10% marks of internal assessment) marks are allocated for each OSPE/OSCE examination.

## Year 3 Professional Exam in System-based Curriculum

Theory paper	Modules	Theory marks	Internal assessment theory (10%)	OSPE/OSPE	Internal assessment OSPE/OSPE (10%)	TOTAL MARKS
Paper G	Foundation-II	120	14	120	14	268
	Inf.&Inflamm.					
Paper H	Multisystem Blood	120	13	120	14	267
	MSK-II					
Paper I	CVS-II	120	13	120	12	265
	Respiratory-II					
<b>TOTAL MARKS</b>		360	40	360	40	800

\*Research viva of 20 marks will be conducted in paper-L. However, the rest of 15 marks will be decided by the concerned department internally for the contribution of the students in research project/thesis.

# Assessment Blueprints

Table 2: Paper H Blood & Immunology MCQs

Subjects	Total MCQs
MSK	44
Multisystem I	41
Blood and Immunology	35
<b>Total</b>	<b>120</b>

Table 3: Blood & Immunology OSCEs

Subjects	Total OSCEs
MSK	10
Multisystem I	0
Blood and Immunology	10
<b>Total</b>	<b>20</b>

A minimum of 20 stations will be used in final exams. Total marks will be 120 (6 marks for each station).