KHYBER MEDICAL UNIVERSITY

MODULE 2
BLOOD & IMMUNOLOGY
1ST YEAR BDS

Contents

Vision & Mission 3
Teaching Hours Allocation 4
Themes for Blood Module 5
Learning Outcomes 6
Cognitive Domain 6
Psychomotor Domain 6
Affective Domain 7
Theme I: Pallor and Swelling 8
Lab Work 10
Theme –II Fever (Infection and Immunology) 11
Lab Work 15
Theme –III Bleeding Gums 16
Lab Work 17
Theme –IV Transfusion Reaction 18
Lab work 19

Vision & Mission

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 2: Hours allocation for different subjects

S. No	Subject	Hours
1	Anatomy	14
2.	Physiology	43
3.	Biochemistry	07
4.	Oral Biology	22
5.	Pathology	06
6.	Pharmacology	01
7.	Oral Medicine	02
8.	Periodontology	03
9.	Community & Preventive dentistry	03
Total		**101**

Themes for Blood Module

SNO	Theme	Duration
1	Pallor and swelling	1 week
2	Fever (Infection and Immunity)	1.5 week
3	Excessive bleeding	1 week
4	Transfusion Reaction	0.5 week
Total		**4 weeks**

Learning Outcomes

Cognitive Domain

By the end of this module, first-year BDS students shall be able:

1. Describe the various cellular and non-cellular components of blood in relation to its Anatomy, Physiology & Biochemistry.
2. Describe the structure, synthesis, and degradation of Hemoglobin.
3. Describe the regulatory mechanisms of normal hemostasis and coagulation.
4. Describe the conditions associated with the dysfunction of cellular and non-cellular components of blood.
5. Describe the basic characteristics of the immune system.
6. Discuss the structure, functions, and biochemical aspects of the Lymphoreticular system.
7. Explain the principles and clinical significance of the ABO/RH blood grouping system.
8. Explain the pathophysiology of various bleeding disorders.
9. Identify the role of pharmacology in anemia and bleeding disorders.

Psychomotor Domain

Description of the psychomotor skills to be developed and the level of performance required:

By the end of the Blood Module, the student should be able to:

1. Perform practical work as instructed in an organized and safe manner
2. Record observations accurately.
3. Identify slides of the Lymph node, thymus, tonsils, and spleen under the microscope.
4. Identify the slide of Gut-associated lymphoid tissue.
5. Determine the percentage of formed blood elements.

6. Identify RBC and should be able to do its counting-on-counting chamber and to know normal values. And also classify Anemia morphologically.
7. Determine the Hemoglobin with the apparatus and have knowledge of normal and abnormal values.
8. Identify WBC morphology and its different types to count them on the counting chamber and know the normal values. Diagnostic importance of each WBC.
9. Identify Platelets and should be able to do its counting on the counting chamber and to know normal values. Its diagnostic importance in relation to bleeding disorders.
10. Perform bleeding time and clotting time, know normal values and their diagnostic importance in relation to bleeding disorders.
11. Perform Blood group typing and Rh factor.
12. Perform ESR and to know its normal value and prognostic importance.
13. Detect blood, bile pigments & bile salts in the given sample of urine.

Affective Domain

By the end of the Blood Module, the student should be able to.

1. Demonstrate ability to give and receive feedback and respect for self and peers.
2. Demonstrate empathy and care to patients.
3. Develop respect for the individuality and values of others - (including having respect for oneself), patients, colleagues, and other health professionals.
4. Organize and distribute tasks.
5. Exchange opinion & knowledge.
6. Develop communication skills and etiquette with a sense of responsibility.
7. Equip themselves with teamwork.
8. Regularly attend the classes.
9. Demonstrate good laboratory practices.

Theme I: Pallor and Swelling			
Subject	**Topic**	**Hours**	**Learning objectives**
Physiology	Introduction to Blood	1hr	1. Describe the composition and functions of blood. 2. Describe the various red cell indices. 3. Enlist the components of plasma. 4. Explain the difference between serum and plasma.
	Red Blood Cells	1hr	5. Describe the structure, function, life span and normal count of red blood cells.
	Introduction to hematopoietic system	2hr	6. Define Hematopoiesis. 7. Classify hematopoietic stem cells. 8. Describe various components of hematopoietic. system including their locations and their functions. 9. Describe the erythropoiesis sites during pre-natal and postnatal periods.
	Red Blood Cells Genesis (Erythropoiesis)	1hr	10. Discuss the stages of RBC development from pluripotent hematopoietic stem cells to a mature RBC. 11. Describe the erythropoiesis and factors regulating erythropoiesis. 12. Describe the role of Vitamin B12 and Folic acid in RBC maturation. 13. Describe the effects of deficiency of Vita- min B12 and Folic acid on RBC maturation.
	Erythropoietin	1hr	14. Describe source, control / regulation, and functions of Erythropoietin 15. Explain the role of Erythropoietin in RBC production. 16. Describe the effects of high altitude and exercise on RBC production.
	Anemia	1hr	17. Define and describe the different types of anemia 18. Define hemolysis. 19. Interpret the diagnosis of anemia by using red cell indices.

			20. Describe the effects of anemia on functions of circulatory system / human body.
	Polycythemia	1hr	21. Define and classify polycythemia. 22. Differentiate between primary and secondary Polycythemia.
Biochemistry	Introduction of Porphyrins	1hr	23. Define Porphyrins. 24. Describe Chemistry of Porphyrins. 25. Enlist the types, metabolic causes, and clinical presentation of different types of Porphyria's.
	Iron metabolism	1hr	26. Describe the iron metabolism.
	Introduction to heme synthesis and degradation	1hr	27. Define heme and describe its structure and functions. 28. Describe the biochemical features of the hemoglobin molecules. 29. Describe Heme Synthesis on cellular and molecular level. 30. Describe Heme Degradation. 31. Describe the Regulation of Heme Synthesis. 32. Describe the concept of Oxygen binding with hemoglobin. 33. Describe the normal picture of blood chemistry.
	Hemoglobinop athies	3hrs	34. Define Hemoglobinopathies and enlist the variants of hemoglobin. 35. Describe causes of Hemoglobinopathies. 36. Describe two major categories of hemoglobinopathies. 37. Describe the amino acid substitution in sickle cell disease. 38. Define and Classify thalassemia's. 39. Explain the genetic defects in α and ß thalassemia's. 40. Enlist the clinical features of α and ß thalassemia's. 41. Discuss the role of vit B12 and Folic acid in prevention of anemia. 42. Describe abnormalities of iron metabolism. 43. Discuss 2,3 BPG.

Pathology	Anemias of diminished erythropoiesis and Hemolytic anemia's	2hr	44. Define anemia. 45. List the factors for regulation of erythropoiesis. 46. Enlist the types of anemia.
			47. Define hemolytic anemia. 48. Enlist types of hemolytic anemia. 49. Discuss pathophysiology of hemolytic anemias.
Pharmacology	Drug treatment of anemia's	1hr	50. Enlist the drugs used in the treatment of iron deficiency & Megaloblastic anemia. 51. Describe the pharmacological basis/ role of iron in iron deficiency anemia (hypochromic normocytic anemia). 52. Describe the pharmacological basis/ role of vitamin B12 and folic acid in megaloblastic anemia. 53. Describe the role of erythropoietin in the treatment of anemia (normochromic normocytic anemia).
Oral medicine	Oral manifestation of anemia	1hr	54. Enlist oral manifestations of anemia. 55. Discuss various oral conditions associated with anemia.
Lab Work			
Physiology	Hemoglobin Determination	2hrs	56. Assist the procedure of phlebotomy while practicing asepsis. 57. Determine the hemoglobin (Hb) concentration in the given sample by Sahli's method. 58. Determine the ESR.
	Blood cells	2hrs	59. Identify and describe various blood cells under microscope. 60. Determine the blood cell count and cell indices by hemocytometer.

Theme –II Fever (Infection and Immunology)			
Subject	**Topic**	**Hour**	**Learning Objectives**
Anatomy	Gross anatomy of hematopoietic system	1hr	61. Classify the lymphoid organs and lymphoid tissues. 62. Describe the main gross external features of spleen, lymph node, thymus and oral mucosils. 63. Describe neurovascular supply of the mentioned structures
	Histology of lymphoid tissues	4hrs	64. Describe the overview of lymphatic tissue including MALT. 65. Identify and describe the histological features and functions of lymph node. 66. Identify and describe the histological features and functions of thymus. 67. Describe the histological features and functions of tonsils 68. escribe the histological features and functions of spleen.
Physiology	White Blood Cells	1hr	69. Classify white blood cells. 70. Describe the structure, function, life span and normal count of white blood cells. 71. Describe the stages of differentiation of white blood cells (leukopoiesis). 72. Describe the characteristics of WBCs (phagocytosis/chemotaxis, diapedesis).
	Reticuloendothelial (Monocyte-Macrophage) system	2hrs	73. Describe the components of reticulo-endothelial system (monocyte-macrophage system). 74. Describe the role of monocyte macrophage system in immunity.

			75. Explain the role of neutrophils, macrophages, basophils, eosinophils, and monocytes in providing immunity against infections (immune system).
Pathology	Inflammation	1hr	76. Define inflammation. 77. Enlist the types of inflammation. 78. Describe characteristics of inflammation (hallmark of inflammation).
	Abnormal Leukocyte counts/ Leukemia		79. Define leukopenia and leukocytosis and Leukemia.
Physiology	Introduction to immunity	1hr	80. Define and classify immunity. 81. Define antigen. 82. Define pathogen. 83. Enlist the tissues that contribute to immunity and explain their function. 84. Describe the functions of immune system. 85. Describe the structure and function of lymphatic system.
Physiology	Immune system	1hr	86. Enlist the three lines of defenses. 87. Describe the properties of three lines of defenses. 88. Describe the characteristics, origin, and functions of cells of immune system. 89. Describe the types of immunity. 90. Enlist the innate defenses. 91. List the substances and cells that participate in adaptive immunity. 92. Compare the characteristics innate and acquired immunity. 93. Compare the active and passive immunity mechanism.

Physiology	Humoral and cell mediated immunity	2hrs	94. Describe the role of T and B lymphocytes in immunity. 95. Describe cell mediated and humoral immunity. 96. Explain how helper T cells regulate the immune system. 97. Explain the function of cytotoxic T cells. 98. Describe the role of helper T cells. 99. Differentiate between humoral and cell mediated immunity.
	Complement system	2hrs	100. Describe the complement system. 101. Explain how the complement system elicits the inflammatory response, lyses foreign cells, and increases phagocytosis. 102. Describe the two pathways that activate the complement system. 103. Compare Classic and alternate pathways of complement activation.
	Immunity in extreme of ages (Paediatrics to Geriatics)	1hr	104. Compare the active and passive immunity. 105. Explain transfer of passive immunity from mother to infant through breast feeding. 106. Describe changes in immune response that occur with aging.
	Allergy & Hypersensitivity	1hr	107. Define allergy and allergen. 108. Describe the pathophysiology of allergy and hypersensitivity. 109. Define and classify the hypersensitivity reaction. 110. Compare the immediate and delayed hypersensitivity reactions. 111. List the diseases associated with hypersensitivity reactions.
Biochemistry	Immunoglobulin's /Antibodies	1hr	112. Define Immunoglobulins. 113. Describe the types of Immunoglobulins. 114. Describe Structure of Immunoglobulins. 115. Describe the mechanism of action of antibodies. 116. Explain biochemical role of each immunoglobulin in immunity.

Oral Biology	Dental pulp and PDL	4hrs	117. Discuss anatomy of pulp including coronal and radicular pulp. 118. Describe the histology of pulp including cells, ground substance, fibers, blood and nerve supply and lymphatic drainage. 119. Identify microscopic zones of pulp with detailed theoretical and diagrammatic representation. 120. Describe functions of pulp. 121. Differentiation of pulp of primary and permanent dentition. 122. Discuss regressive changes of pulp (age changes). 123. Explain development of pulp. 124. Draw different microscopic zones of pulp with labelling. 125. Describe the overview of pulpitis and extravasation. 126. Differentiate types and properties of pulpal sensory nerve fibers. 127. Define pulpitis and its types, pulp polyps, pink tooth pulp necrosis. 128. Interpret the number of root canals its configuration and position of apical foramen for endodontic procedures.
	Periodontal Ligament (PDL)	6hrs	129. Define Periodontal Ligament (PDL). 130. Explain in detail the development of principle fibers and cells of PDL. 131. Explain PDL homeostasis which helps to maintain the width of PDL. 132. Describe cells of PDL under headings of synthetic, resorptive, defense, progenitor cells and epithelial rest cells of Malassez. 133. Name markers of PDL and growth factors involved in normal biology. 134. Discuss the functions of PDL. 135. Discuss cell biology of PDL. 136. Enumerate the principal fibers of PDL with complete description of course and functions. 137. Describe composition of ground substance of PDL and its functions. 138. Describe synthetic cells and their individual function in detail. 139. Discuss clinical correlation of PDL with operative, surgical, and orthodontic procedures and conventional to latest treatment modalities for periodontal inflammatory diseases.

Community & Preventive Dentistry	Prevention of periodontal diseases	1hr	140. Epidemiology, etiology, and prevention of periodontal diseases
Lab Work			
Histology		2hrs	141. Identify and describe the microscopic anatomy of bone marrow and spleen under microscope
Anatomy		4hrs	142. Identify histological features of lymph nodes, spleen, thymus and tonsils.
	TLC Determination	2hrs	143. Determine the total leukocyte count (TLC) in the given sample
	DLC Determination	2hrs	144. Determine the differential leukocyte count (DLC) in the given sample

Theme –III Bleeding Gums			
Physiology	Introduction to hemostasis	1hr	145. Describe the structure, function, life span and normal count of Platelets. 146. Define hemostasis. 147. Describe the role of platelets in hemostasis. 148. Outline the sequence of processes involved in hemostasis.
	Blood Coagulation	3hrs	149. Enlist the clotting factors. 150. Explain the role of calcium in coagulation. 151. Explain how clotting is prevented in the normal vascular system. 152. Outline the sequence of processes during blood coagulation. 153. Describe with the help of a flow diagram (or draw) intrinsic pathway of coagulation cascade. 154. Describe with the help of a flow diagram (or draw) extrinsic pathway of coagulation cascade. 155. Explain how the mechanism of clot dissolution.
Pathology	Bleeding disorders	1hr	156. Describe the role of Vitamin K in clotting. 157. Describe the following bleeding disorders: Vitamin K deficiency, Thrombocytopenia, Hemophilia. 158. Define Von Willebrand disease.
	Thrombotic disorders	1hr	159. Describe the effects of low platelet count on Hemostasis. 160. Define thrombus/thrombi. 161. Define emboli/embolus. 162. Enlist the causes of thromboembolic conditions.
Oral Biology	Oral mucosa	6hrs	163. Define oral mucosa and classify on basis of function and histophysiology, into lining mucosa, masticatory mucosa, and specialized mucosa. 164. Describe structure of Oral epithelium, Basement membrane, Lamina Propria, Sub mucosa. 165. Describe functions of oral mucosa, compare with intestinal and skin mucosa.

			166. Enlist the histological differences between keratinized &non keratinized oral epithelium. 167. Elaborate cells of OMM that is Keratinocytes and Non-keratinocytes, Melanocytes Langerhans cells & Merkel cells. (shift to bleeding gums theme in blood module). 168. Identify histological features, location, and function of tongue papillae & taste buds, 169. Correlate Gingival sulcus, dento-gingival junction mucocutaneous junction. (shift to bleeding gums theme in blood module). 170. Explain development of OMM, age changes, blood supply &nerve supply of oral mucosa. 171. Discuss the clinical significance of oral mucosa.
Periodontology	Effects of hemo diseases on Periodontium (Thrombocytopenia, Leukemia & Scurvy)	2hrs	172. Define Thrombocytopenia. 173. Classify Thrombocytopenia. 174. Discuss periodontal manifestations of thrombocytopenic purpura. 175. Define scurvy. 176. Discuss clinical features of scurvy. 177. Discuss the association of gingivitis with Vit C deficiency. 178. Discuss the association of periodontitis with Vit C deficiency. 179. Describe periodontal manifestations of leukemia.
Community & Preventive Dentistry	Nutritional deficiencies	1hr	180. Discuss the effects of nutritional deficiencies on oral health.
Oral Medicine	Thrombocytopenia	1hr	181. Describe oral manifestations of Thrombocytopenia. 182. Idiopathic Thrombocytopenic purpura.
Lab Work			
Physiology Oral Biology	Blood Coagulation	2hrs 2hrs (2+2+2)	183. Perform BT and CT time. 184. Perform PT and APTT. 185. Identify structures of PDL, pulp and oral mucosa in slides

Theme –IV Transfusion Reaction			
Physiology	Blood Grouping	2hrs	186. Describe different types of blood groups. 187. Describe the genotype phenotype relationships in blood groups. 188. Interpret the plausible blood groups (A-B-O) in children of parents with known blood groups. 189. Describe the role of agglutinogens and agglutinins in blood grouping. 190. Describe the antigens and antibodies of the O-A-B blood types 191. Interpret the types of agglutinins present in individuals with a specific blood group. 192. Describe the process of agglutination.
	Transfusion reactions	1hr	193. Describe the antigens and antibodies of the Rh system. 194. Describe the principles of blood typing. 195. Explain universal donor and universal recipient blood groups.
	Erythroblastosis fetalis	1hr	196. Enlist the manifestations of transfusion reaction. 197. Define Rhesus incompatibility. 198. Describe erythroblastosis fetalis. 199. Describe the transfusion reactions. resulting from mismatched O-A-B and Rh blood types.
Pathology	Transfusion reaction and organ transplant	1hr	200. Discuss transfusion reaction and organ transplant. 201. Explain the criteria for transplant, donor, recipient, role of immune system in transplant, different types of transplants.
Periodontology	Relationship of periodontal diseases with hematological & Immune disorders	1hr	202. Discuss anemia & its oral presentation. 203. Discuss leukemia & its oral presentation. 204. Discuss thrombocytopenia & its oral presentation. 205. Discuss leukocytic disorders (neutropenia, agranulocytosis & certain syndromes) & their oral presentation.

Community & Preventive Dentistry	Epidemiology of blood borne diseases	1hr	206. Identify blood borne pathogens. 207. Epidemiology of blood borne disease transmission. 208. Routes of transmission \ 209. Best practices to perform safe blood transfusion. 210. Identify potential risks of exposures. 211. Enlist important safeguards against blood borne pathogens.
Lab Work			
Physiology	Blood grouping	2hrs	212. Determine the O-A-B and Rh blood group in the given sample.
	Blood smear preparation	2hrs	213. Prepare blood smear needle by prick method.
	Blood Bank	2hrs	214. Observe the process of blood donation, blood product separation, screening and storage and observe the process of blood transfusion.