



BLOOD MODULE

STUDY GUIDE

KGMC

This Study guide of the Blood module outlines the key components and areas for the facilitation of the students.

Department of Medical Education

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Vision and Mission of KGMC

Khyber Medical University: Vision



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

Khyber Girls Medical College: Vision



“Excellence in health care, research ,teaching and training in the service of Humanity”

Khyber Girls Medical College: Mission



The mission of KGMC is to promote compassionate and professional health care leaders Who are knowledgeable, skillful, and community oriented lifelong learners serving humanity through evidence based practice

Curriculum Committee KGMC

Chair:

Professor Dr.Zahid Aman, Dean KGMC.

Co-Chair:

Dr. Sabina Aziz, Associate Dean KGMC.

Clinical Sciences:

Dr. Bushra Rauf Department of Gynae KGMC/HMC.

Dr. Sofia Iqbal, Department of Ophthalmology KGMC/HMC.

Dr. Said Amin Department of Medicine KGMC/HMC.

Dr. Ghareeb Nawaz Department of ENT KGMC/HMC.

Dr. Jamshed Alam Department of Surgery KGMC/HMC.

Dr. Ambreen Ahmad, Department of Pediatrics KGMC/HMC.

Dr. Ain-ul-Hadi Department of Surgery KGMC/HMC.

Dr. Fawad Rahim Department of Medicine KGMC/HMC.

Behavioral Sciences:

Dr. Ameer Abbas Department of Psychiatry KGMC/HMC.

Medical Education

Dr. Naheed Mahsood, Department of Medical Education, KGMC.

Dr. Naveed Afzal Khan, Department of Medical Education, KGMC

Dr. Onaiza Nasim , Department of Medical Education, KGMC

Basic Sciences:

Dr. Amin-ul-Haq Department of Biochemistry, KGMC.

Dr. Khalid Javed Department of Pathology, KGMC.

Dr. Raheela Amin Department of Community Medicine, KGMC.

Dr. Shams Suleman Department of Pharmacology, KGMC.

Dr. Shahab-ud-Din, Department of Anatomy, KGMC.

Dr. Naheed Siddique Department of Forensic Medicine, KGMC.

Dr. Zubia Shah Department of Physiology, KGMC.

Blood Module committee

Module coordinator

Dr. Zahid Ullah, Assistant Professor **Pathology**

Module Head of Assessment

Dr. Khalid javed, Professor **Pathology**

Module Secretary

Dr. Naheed Mahsood Assistant Professor **DME**

Members

Dr. Naveed Afzal Khan Coordinator **DME**

Dr Onazia Nasim Demonstrator **DME**

Dr. Shams Suleman Associate **Admin**

Dr. Shams Suleman, Associate Professor **Pharmacology**

Dr. Nabila Sher, Associate Professor **Biochemistry**

Dr. Alia Manzoor Associate Professor **Community Medicine**

Dr. Zahid Sarfaraz Assistant Professor **Anatomy**

Dr. Ameer Abbass Assistant Professor **psychiatry**

Dr. Kalsoom Tariq Assistant Professor **Biochemistry**

Dr. Rizwanullah Khattak Assistant Professor **Surgical B**

Dr. Bahr-e-Karam, Principal Demonstrator **Physiology**

Dr. Nahecd Sidiqie Assistant Professor **Forensic Medicine**

Dr. Gull Muhammad, Senior Lecturer **Physiology**

Miss. Samar Minallah **Student of Final Year**

Miss. Syeda Kainat **Student of Final Year**

Integrated curriculum:

An integrated curriculum is all about making connections, whether to real life or across the disciplines, about skills or about knowledge. An integrated curriculum fuses subject areas, experiences, and real-life knowledge together to make a more fulfilling and tangible learning environment for students. Integrated teaching means that subjects are presented as a meaningful whole. Students will be able to have better understanding of basic sciences when they repeatedly learn in relation to clinical examples. Case based discussions, computer-based assignments, early exposure to clinics, wards, and skills acquisition in skills lab are characteristics of integrated teaching program.

Outcomes of the curriculum:

The outcomes of the curriculum of MBBS According to the PMDC are as follows

- ✓ Knowledgeable
- ✓ Skillful
- ✓ Community Health Promoter
- ✓ Problem-solver
- ✓ Professional
- ✓ Researcher
- ✓ Leader and Role Model

General Learning Outcomes

COGNITIVE DOMAIN

By the end of this module, First year MBBS students shall be able:

1. Identify & describe the various cellular and non-cellular components of blood in relation to its Anatomy, Physiology & Biochemistry
2. Describe structure, synthesis and degradation of Hemoglobin
3. Describe the regulatory mechanisms of normal hemostasis and coagulation
4. Describe the conditions associated with dysfunction of cellular and non-cellular components of blood
5. Describe the basic characteristics of immune system.
6. Discuss the structure, functions and biochemical aspects of the Lympho-reticular system.
7. Explain the principles and clinical significance of 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 BLOOD Module, the student should be able to:

1. Carry out practical work as instructed in an organized and safe manner
2. Make and record observations accurately.
3. Identify slide of Lymph node, thymus, tonsils and spleen under microscope
4. Identify slide of Gut associated lymphoid tissue
5. Determine 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 value.

8. Identify WBC morphology and its different types, should be able to count them on counting chamber and to know the normal values. Diagnostic importance of each WBC.
9. Identify Platelets and should be able to do its counting on counting chamber and to know normal values. Its diagnostic importance in relation to bleeding disorders
10. Perform bleeding time and clotting time and to know normal values and its diagnostic importance in relation to bleeding disorders.
11. Perform Blood groups 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

ATTITUDE AND BEHAVIOUR:

By the end of BLOOD Module the student shall gain the ability and carry responsibility to:

1. Demonstrate ability to give and receive feedback, 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 & distribute tasks
5. Exchange opinion & knowledge
6. Develop communication skills and etiquette with sense of responsibility.
7. To equip themselves for teamwork
8. Regularly attend the classes
9. Demonstrate good laboratory practices

THEME –I				
Pallor and Swelling				
S.N	Topic	Learning Outcomes	MIT	Assessment
ANATOMY				
1	Introduction to hematopoietic system	Describe various components of hematopoietic system including their locations and their functions Describe surface anatomy and applied anatomy of main organs of hematopoietic system Define and classify lymphoid organs and lymphoid tissues	LGF	MCQ
PHYSIOLOGY				
2	Introduction to Blood	Describe the composition and functions of blood Define Hematocrit Enlist the components of plasma. Explain the difference between Serum and plasma	LGF	MCQ
3	Red Blood Cells	Describe the Structure, function, life span and normal count of Red Blood Cells. Define Haemopoiesis Classify haematopoietic stem cells Summarize the erythropoiesis sites during pre- natal and post- natal periods.	LGF	MCQ

4	Red Blood Cells Genesis Erythropoiesis	<p>Illustrate the stages of RBC development from pluripotent hematopoietic stem cells to a mature RBC.</p> <p>Describe the erythropoiesis and factors regulating erythropoiesis</p> <p>Describe the role of Vitamin B12 and Folic acid in RBC maturation.</p> <p>Describe the effects of deficiency of Vitamin B12 and Folic acid on RBC maturation.</p>	LGF	MCQ
5	Erythropoitin	<p>Describe source, control / regulation and functions of Erythropoitin</p> <p>Explain the role of Erythropoietin in RBC production.</p> <p>Describe the effects of high altitude and exercise on RBC production.</p>	LGF	MCQ
6	Anemia	<p>Define and describe the different types of anemia</p> <p>Define hemolysis</p> <p>Describe the various red cell indices</p> <p>Interpret the diagnosis of anemia by using red cell indices</p> <p>Describe the effects of anemia on functions of circulatory system/ human body</p>	LGF	MCQ
7	Polycythemia	<p>Define and classify polycythemia</p> <p>Differentiate between primary and secondary Polycythemia</p>	LGF	MCQ

BIOCHEMISTRY				
8	Introduction of Porphyrins	Define Porphyrins Describe Chemistry of Porphyrins Enlist the types, metabolic causes and clinical presentation of different types of Porphyrins.	LGF	MCQ
9	Iron metabolism	Describe the iron metabolism	LGF	MCQ
10	Introduction to heme synthesis and degradation	Define heme and Describe its structure and functions Describe the biochemical features of the hemoglobin molecules Describe Heme Synthesis on cellular and molecular level Describe Heme Degradation Describe the Regulation		
11	Hemoglobinopathies	Define Hemoglobinopathies and enlist the variants of hemoglobin Describe causes of Hemoglobinopathies Describe two major categories of hemoglobinopathies Describe the amino acid substitution in sickle cell disease. Define and Classify	LGF	MCQ
12	Water soluble vitamins	Discuss water soluble vitamins including Vitamin B complex Vitamin C Folic Acid	LGF	MCQ

PATHOLOGY				
13	Anemia's of diminished erythropoiesis	Define anemia List the factors for regulation of erythropoiesis Enlist the types of anemia	LGF	MCQ
14	Hemolytic anemia's	Define hemolytic anemia. Enlist types of hemolytic anemia.	LGF	MCQ
PHARMACOLOGY				
15	Drug treatment of anemia's	Enlist the drugs used in the treatment of iron deficiency & Megaloblastic anemia Describe the pharmacological basis/ role of iron in iron deficiency anemia (hypochromic normocytic anemia) Describe the pharmacological basis/ role of vit B12 and folic acid in megaloblastic anemia Describe the role of Erythropoietin in the treatment of Anemia (normochromic	LGF	MCQ
COMMUNITY MEDICINE				
16	Epidemiology of blood borne diseases	54. Describe Epidemiology of Iron Deficiency Anemia 55. Describe prevention of different types of anemia's in community	LGF	MCQ

LAB WORK				
ANATOMY PRACTICAL (HISTOLOGY)				
17	Histology	Identify and describe the microscopic anatomy of lymph node, thymus, bone marrow and spleen under microscope Compare the histological features of lymph node, thymus and spleen	Demo/Practical	MCQ
PHYSIOLOGY PRACTICAL				
18	Hemoglobin Determination	Assist in phlebotomy while practicing aseptic procedure. Determine the hemoglobin (Hb) concentration in the given sample Estimation of hemoglobin by Sahli's method Determination of packed cell volume	Demo/Practical	
19	Blood cells	62. Identify and describe various blood cells under microscope.	LGF	MCQ
20	RBC count	63. Determine the red blood cell (RBC) count in the given sample and calculate RBC indices	LGF	MCQ

THEME –II				
Fever (Infection and Immunology)				
SNO	Topic	Learning Outcomes		
ANATOMY				
23	Gross anatomy of hematopoietic system	Locate, identify and describe the main gross external features of spleen, lymph node, thymus and tonsils Describe neurovascular supply of the mentioned structures Outline the surface anatomy of main lymph nodes, spleen, thymus and tonsils Enlist the causes of splenic injuries	Demo/SG D/LGF	MCQ
24	Histology of lymphoid tissues	Describe the overview of lymphatic tissue including MALT Identify and describe the histological features and functions of Lymph node Identify and describe the histological features and functions of Thymus Identify the locations of tonsils and describe the histological features and functions of Tonsils Describe the histological features and functions of spleen.	LGF	MCQ
25	Embryology/ Developmental Anatomy of lymphoid tissue	Describe the development of lymphoid organs including lymph nodes, tonsils, thymus and spleen	LGF	MCQ

PHYSIOLOGY				
			LGF	MCQ
26	White Blood Cells	<p>Classify white blood cells</p> <p>Describe the structure, function, life span and normal count of White Blood Cells</p> <p>Describe the stages of differentiation of white blood cells (leukopoiesis)</p> <p>Describe the characteristics of WBCs (phagocytosis/chemotaxis, diapedesis)</p>		
27	Reticulo-endothelial (Monocyte-Macrophage) system	<p>Describe the components of reticulo- endothelial system (monocyte-macrophage system)</p> <p>Describe the role of monocyte macrophage system in immunity</p> <p>Explain the role of neutrophils, macrophages, basophils, eosinophils and monocytes in providing immunity against infections (immune system)</p>	LGF	MCQ
28	Inflammation	<p>Define inflammation</p> <p>Describe characteristics of inflammation (hallmark of inflammation)</p> <p>Describe the causes, sequence of events and cardinal signs of inflammation.</p>	LGF	MCQ
29	Abnormal leukocyte counts/ Leukemia	<p>Define Leukopenia and Leukocytosis and Leukemia</p>	LGF	MCQ

30	Introduction to immunity	Define and classify immunity Define antigen Define pathogen Enlist the tissues that contribute to immunity and explain their function Describe the functions of immune system Describe the structure and function of lymphatic system	LGF	MCQ
31	Immune system	Enlist the three lines of defenses and outline their properties Describe the characteristics, origin and functions of cells of immune system Describe the types of immunity Enlist the innate defenses List the substances and cells that participate in adaptive immunity Compare the characteristics innate and acquired immunity Compare the active and passive immunity mechanism	LGF	MCQ
32	Immune response	Differentiate between primary and secondary immune response Describe the roles of cytokines, chemokines,	LGF	MCQ
		and colony-stimulating factors in the immune response		

33	Humoral and cell mediated immunity	<p>Describe the role of T and B lymphocytes in immunity</p> <p>Describe the role of B lymphocytes in humoral immunity</p> <p>Describe cell mediated and humoral immunity</p> <p>Explain how helper T cells regulate the immune system</p> <p>Explain the function of cytotoxic T cells</p> <p>Describe the role of helper T cells</p> <p>Differentiate between humoral and cell mediated immunity</p>	LGF	MCQ
34	Complement system	<p>Describe the complement system</p> <p>Explain how the complement system elicits the inflammatory response, lyses foreign cells, and increases phagocytosis</p> <p>Describe the two pathways that activate the complement system</p> <p>compare Classic and alternate pathways</p> <p>pathways of complement activation</p>	LGF	MCQ

35	Immunity: extremes of ages	<p>Compare the active and passive immunity</p> <p>Explain the transfer of passive immunity from mother to fetus and from mother to infant during breast-feeding</p> <p>Describe changes in immune response that occurs with aging</p>	LGF	MCQ
			LGF	MCQ
36	Allergy & Hypersensitivity	<p>Define allergy and allergen</p> <p>Describe the pathophysiology of allergy and hypersensitivity</p> <p>Define and classify the hypersensitivity reaction</p> <p>Compare the immediate and delayed hypersensitivity reactions</p> <p>List the diseases associated with hypersensitivity reactions</p>	LGF	MCQ
Biochemistry				
37	Immunoglobulin's / Antibodies	<p>Define Immunoglobulin's</p> <p>DESCRIBE Types of Immunoglobul in's</p> <p>Describe Structure of Immunoglobul in's</p> <p>Describe the mechanism of action of antibodies</p> <p>Explain biochemical role of each immunoglobulin in immunity</p>	LGF	MCQ

COMMUNIUTY MEDICINE				
38	Vaccinology	Define vaccine and immunization Explain the expanded program of immunization (EPI) in Pakistan	LGF	MCQ
LAB WORK				
PHYSIOLOGY PRACTICAL				
39	TLC determination	Determine the total leukocyte count (TLC) in the given sample	LGF	MCQ
40	DLC determination	Determine the differential leukocyte count (DLC) in the given sample	LGF	MCQ

THEME –III
Excessive Bleeding

PHYSIOLOGY

SN O	Topic	Learning Outcome	LGF	MCQ
41	Introduction to hemostasis	Describe the structure, function, life span and normal count of Platelets. Define hemostasis Describe the role of platelets in hemostasis Outline the sequence of processes involved in hemostasis.	LGF	MCQ
42	Blood Coagulation	Enlist the clotting factors Explain the role of calcium in coagulation Explain how clotting is prevented in the normal vascular system Outline the sequence of processes during blood coagulation Describe with the help of a flow diagram (or draw) intrinsic pathway of coagulation cascade Describe with the help of a flow diagram (or draw) extrinsic pathway of coagulation cascade Explain how the mechanism of clot dissolution.	LGF	MCQ
43	Bleeding disorders	Describe the role of Vit K in clotting Describe the following bleeding disorders - Vitamin K deficiency - Thrombocytopenia - Hemophilia Define Von Willebrand disease	LGF	MCQ
44	Thrombotic disorders	Describe the effects of low platelet count on Hemostasis Define thrombus/thrombi Define emboli/embolus Enlist the causes of thromboembolic conditions Describe Femoral venous thrombosis and pulmonary embolism	LGF	MCQ

Pharmacology				
45	Coagulation modifying drug	Identify the site of action of following drugs in coagulation cascade <ul style="list-style-type: none"> ✓ Aspirin, ✓ Heparin, ✓ Tranexamic acid ✓ Vit K 	LGF	MCQ
LAB WORK				
46	Clotting time determination	Determine the clotting time	DEMO/SGD	MCQ
47	Bleeding time determination	Determine the bleeding time	DEMO/SGD	MCQ
48	Prothrombin time determination	Determine the Prothrombin time (PT) in the given sample	DEMO/SGD	MCQ
THEME –IV				
Transfusion Reaction				
SNO	Topic	Learning Outcome		
PHYSIOLOGY				
49	Blood Grouping	Describe different types of blood groups Describe the genotype-phenotype relationships in blood groups. Interpret the plausible blood groups (A-B-O) in children of parents with known blood groups. Describe the role of agglutinogens and agglutinins in blood grouping Describe the antigens and antibodies of the O-A-B blood types/ Interpret the types of agglutinins present in individuals with a specific blood group Describe the process of agglutination	LGF	MCQ
50	Transfusion reactions	Describe the antigens and antibodies of the Rh system Describe the principles of blood typing Explain universal donor and universal recipient blood groups Enlist the manifestations of transfusion reaction	LGF	MCQ
51	Erythroblastosis fetalis	Define Rhesus incompatibility Describe erythroblastosis fetalis Describe the transfusion reactions resulting from mismatched O-A-B and Rh blood types	LGF	MCQ

52	Major histocompatibility complex	Define autoimmunity Explain how immune reaction to self-antigens is avoided Define and classify Major Histocompatibility complex (MHC) Characterize the significance and function of major histocompatibility complex molecules	LGF	MCQ
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Forensic Medicine

53	Medico-legal importance of blood groups	Describe the Medico-legal importance of blood groups in forensic work that is (a) Personal Identity (b) inheritance claims (c) DNA profiling (d) Disputed paternity and maternity	LGF	MCQ
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COMMUNITY MEDICINE

54	epidemiology of blood borne diseases	Identify important blood borne pathogens and how they are spread Discuss the epidemiology of blood borne disease transmission and the potential for HIV, HBV and HCV transmission. Identify routes of transmission of blood borne pathogens Discuss the best practices to perform safe blood transfusion. Identify potential exposure risks List important safeguards against blood borne pathogen disease	LGF	MCQ
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LAB WORK (Physiology Practical)

55	Blood grouping	Determine the O-A-B and Rh blood group in the given sample	DEMO/Practical	MCQ
56	Blood smear preparation	Prepare blood smear by thumb prick method	DEMO/Practical	MCQ
70	Blood Bank	Observe the process of blood donation, blood product separation, screening and storage and observe the process of blood transfusion.	DEMO/Practical	MCQ

Teaching and learning strategies:

The following teaching / learning methods are used to promote better understanding:

- Interactive Lectures
- Hospital / Clinic visits
- Small Group Discussion
- Skills session
- Self-Directed Study



Interactive lectures:

An interactive lecture is an easy way for instructors to intellectually engage and involve students as active participants in a lecture-based class of any size. Interactive lectures are classes in which the instructor breaks the lecture at least once per class to have students participate in an activity that lets them work directly with the material.

- The instructor might begin the interactive segment with an engagement trigger that captures and maintains student attention.
 - Then the instructor incorporates an activity that allows students to apply what they have learned or give them a context for upcoming lecture material.
 - As the instructor feels more comfortable using interactive techniques he or she might begin to call upon a blend of various interactive techniques all in one class period.
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Hospital / Clinic visits:

In small groups, students observe patients with signs and symptoms in hospital or clinical settings. This helps students to relate knowledge of basic and clinical sciences of the relevant module.

Small group discussion (SGD):

The shy and less articulate are more able to contribute. Students learn from each other. Everyone gets more practice at expressing their ideas. A two way discussion is almost always more creative than individual thoughts. Social skills are practiced in a 'safe' environment e.g. tolerance, cooperation. This format helps students to clarify concepts acquire skills or attitudes. Students exchange opinions and apply knowledge gained from lectures, tutorials and self-study. The facilitator role is to ask probing questions, summarize, or rephrase to help clarify concepts.

Skills/Practical session:

Skills relevant to respective module are observed and practiced where applicable in skills laboratory or Laboratories of various departments.

Self-Directed learning (SDL):

Self-directed learning, which involves studying without direct supervision in a classroom/Library, is a valuable way to learn and is quickly growing in popularity among parents and students. Students' assume responsibilities of their own learning through individual study, sharing and discussing with peers, seeking information from Learning Resource Centre, teachers and resource persons within and outside the college. Students can utilize the time within the college scheduled hours of self-study.

Time tables:

The timetables for the module will be shared via Edmodo and the notice boards in advance.

Assessment tools:

Theoretical knowledge is tested by a written examination system constituted by multiple choice questions (MCQs). The assessment of practical knowledge involves oral, spot, or objective structured practical examinations (OSPE).

Multiple Choice Questions (MCQs):

- Multiple choice questions (MCQs) are a form of assessment for which students are asked to select the best choice from a list of answers.
- MCQ consists of a stem and a set of options. The stem is usually the first part of the assessment that presents the question as a problem to be solved; the question can be an incomplete statement which requires to be completed and can include a graph, a picture or any other relevant information. The options are the possible answers that the student can choose from, with the correct answer called the key and the incorrect answers called distractors.
- Correct answer carries one mark, and incorrect 'zero mark'. There is NO negative marking.
- Students mark their responses on specified computer-based sheet designed for the college.

- ✓ The block exam will comprise of 120 MCQs and will be compiled according to the shared blueprint.

Objective Structured Practical Examination (OSPE):

- ✓ The content may assess application of knowledge, or practical skills.
- ✓ Student will complete task in define time at one given station.
- ✓ All the students are assessed on the same content by the same examiner in the same allocated time.
- ✓ A structured examination will have observed, unobserved, interactive and rest stations.
- ✓ Observed and interactive stations will be assessed by internal or external examiners.
- ✓ Unobserved will be static stations in which students will have to answer the questions related to the given pictures, models or specimens the provided response sheet.
- ✓ Rest station is a station where there is no task given, and in this time student can organize his/her thoughts.
- ✓ The Block OSPE will be comprise of 18 examined station and 7 rest stations. The stations will be assigned according to the shred blueprint.

Internal Evaluation:

Internal evaluation is a process of quality review undertaken within an institution for its own ends. 10% marks of internal evaluation will be added to final marks. This 10% will be based on

Distribution of 14 Marks for Block A paper	
Marks based on Score in the Block A paper	Marks Allocated Based on Discipline/ Attendance
7	7

Distribution of 10 Marks for Block A OSPE	
Marks based on Score in Block A OSPE	Marks Allocated Based on End of Year Viva
5	5

Attendance Requirement:

More than 75% attendance is mandatory to sit for the modular examinations.

Learning resources:

The learning resources are as follows:

Anatomy

- ✓ Clinical Anatomy by Regions by Richard S. Snell
- ✓ Gray's Anatomy for Students
- ✓ Langman`s Medical Embryology-14thEdition
- ✓ The Developing Human “by Keith L Moore”-10thEdition
- ✓ Textbook of Histology by Junqueira
- ✓ Atlas of human Histology by Wheaters. 11thEdition
- ✓ <http://www.anatomyzone.com/>, <https://www.youtube.com/user/TheAnatomyZone>

Physiology

- ✓ Guyton and Hall Textbook of Medical Physiology
- ✓ Ganong's Review of Medical Physiology
- ✓ Human Physiology : Lauralee Sherwood

Biochemistry

- ✓ Textbook of medical biochemistry by Chatterjee-8thEdition
- ✓ Harpers Illustrated Biochemistry
- ✓ Lippincott's Illustrated Reviews: Biochemistry

Presentations for the classes and other relevant materials will be shared during the module via Edmodo.