



## The Hashemite University

### Course Syllabus

#### Hematopoietic and Lymphatic System (HLS)

1	Course title	Hematopoietic and Lymphatic System
2	Course number	111501207
3	Credit hours (theory)	5
	Contact hours (theory)	Lectures: 43 hours Practical: 7 hours
4	Course meeting time	Variable
	Course location	
5	Program title	Doctor of Medicine
7	Awarding institution	The Hashemite University
8	Faculty	Faculty of Medicine
9	Department	Basic medical sciences
10	Level of course	Second year medical students
11	Year of study and semester (s)	2018/2019 second semester
12	Final Qualification	MD degree
13	Other department (s) involved in teaching the course	None
14	Language of Instruction	English
15	Date of production/revision	01/2019

**Course Coordinator:**

Dr. Walaa Bayoumie El Gazzar.  
 School of Medicine  
 Office number: 3032  
 Office hours: Sunday: 9 AM to 11 AM / Thursday: 11 AM to 1 PM  
 Email: bioch\_2004@yahoo.com

**Intended Learning Outcomes (ILOs):*****By the end of the course the students will be able to:***

- 1- **Describe** the constituents of peripheral blood, their origin & function.
- 2- **Describe** the structure, morphology and function of normal bone marrow.
- 3- **Describe** the development of hematopoietic & lymphoid tissue.
- 4- **Describe** the important aspects of hemoglobin genetics & abnormal hemoglobin synthesis.
- 5- **Understand** the basic classification systems of anemia, their laboratory & clinical features, public health aspects & their managements.
- 6- **Describe** the normal lymph node appearances both gross & microscopic exam.
- 7- **Describe** the normal spleen both grossly & microscopically.
- 8- **Describe** the regulatory mechanisms of normal hemostasis, abnormalities that lead to bleeding disorders, pathologic aspects that cause thrombotic disorders & how are these conditions treated.
- 9- **Identify** the various thrombocytes disorders as thrombocytopenia.
- 10- **Identify** the various white blood cells disorders as leukocytosis & leucopenia.
- 11- **Identify & classify** the various types of leukemias.
- 12- **Describe** the various lymphoid diseases, whether reactive, inflammatory or neoplastic.
- 13- **Discuss** the morphology of various types of lymphomas, their grading & staging.
- 14- **Describe** the microorganisms that infect the hematopoietic & lymphoid systems
- 15- **Regarding** drug therapy, to Identify prototype drugs used in prevention & treatment of hematopoietic & lymphoid system diseases: to describe the pharmacological actions of these drugs on various organs to identify the adverse effects, precautions & contraindications related to their use, & to appreciate the importance of individualization of drug therapy.

**Topic Outline and Schedule:**

Topic	Lecture outline
<b>Anatomy</b>	
<b>Lectures 1, 2 &amp; 3</b> <b>Anatomy &amp; Histology lectures: Blood</b>	1- Describe the blood tissue. 2- List the composition of blood 3- Describe the blood plasma. 4- Classify formed elements of blood 5- Name the organs responsible for hematopoiesis in the fetus 6- List the developmental stages of hematopoiesis both prenatally & postnatally 7- Discuss the structure & function of red blood cells (RBCs) 8- Describe Erythropoiesis

	<p>9- Discuss the structure &amp; functions of granular &amp; agranular leucocytes</p> <p>10- Describe platelets (thrombocytes)</p> <p>11- Discuss the process of formation of platelets</p>
<p><b>4<sup>th</sup> &amp; 5<sup>th</sup> lectures: Anatomy &amp; Histology lectures: Lymphatic system</b></p>	<p>1- Describe the lymphatic system</p> <p>2- List the composition of the lymphatic system</p> <p>3- Review the importance of the lymphatic system</p> <p>4- Describe the origin &amp; composition of lymph</p> <p>5- Describe lymphatic vessels &amp; differentiate between blood capillaries &amp; lymphatics</p> <p>6- Describe lymph trunks and lymph ducts</p> <p>7- Describe the thoracic duct &amp; the right lymphatic duct</p> <p>8- Describe the formation &amp; flow of lymphatics</p> <p>9- Describe the lymphatic organs &amp; tissues</p> <p>10- Describe the primary lymph organs, Thymus &amp; red bone marrow</p> <p>11- Describe the secondary lymphatic organs: Lymph nodes, spleen, tonsils &amp; Lymphatic nodules</p>
<h2>Physiology</h2>	
<p><b>First physiology lecture: Blood, composition &amp; function</b></p>	<p>1- Describe the fluid portion of blood, in which blood cellular elements are suspended</p> <p>2- Explain what properties that made the blood to act as a transporting media</p> <p>3- Describe the constituents of plasma, &amp; how they attributed to the general function of the plasma</p> <p>4- What are the cellular elements of the blood?</p>
<p><b>Second &amp; third physiology lectures: R.B.Cs: characteristics &amp; functions</b></p>	<p>1- State that RBCs are non-nucleated biconcave discs elastic, their number in peripheral blood</p> <p>2- Sites of formation, discuss the normal percentage of reticulocytes of the whole circulating red blood cells. Explain what it does mean the increase in this percentage?</p> <p>3- Describe the main constituents of RBCs &amp; how they contribute to the RBCs function</p> <p>4- How RBCs are regulated, the effect of hypoxia</p> <p>5- Describe the role of iron, vitamin B12 &amp; folic acid deficiency</p> <p>6- Describe the clinical consequence of iron, vitamin B12 &amp; folic acid deficiency</p> <p>7- Discuss the laboratory classification of anemia. The absolute values</p>
<p><b>4<sup>th</sup> physiology lecture: WBCs characteristics &amp; functions</b></p>	<p>1- How to recognize different WBCs types &amp; describe their site of production, life span &amp; function</p> <p>2- Describe the properties of phagocytic WBCs and physiological leukocytosis</p> <p>3- Describe the tissue macrophages &amp; the reticulo-endothelial system</p>
<p><b>5<sup>th</sup> Physiology lecture: Physiology of homeostatic &amp; blood coagulation</b></p>	<p>1- Define homeostasis &amp; describe the steps involved in homeostasis.</p> <p>2- Discuss the role of blood platelets in homeostasis</p> <p>3- Describe the key reaction in blood coagulation, the</p>

	<p>intrinsic &amp; extrinsic pathways in blood coagulation</p> <p>4- Describe the mechanism of anticoagulants</p> <p>5- Describe conditions that lead to excessive bleeding &amp; blood coagulation test</p>
<p><b>6<sup>th</sup> physiology lectures</b></p> <p><b>Blood group</b></p>	<p>1- On what basis human blood is typed into different blood groups?</p> <p>2- Describe the ABO &amp; Rh systems of blood grouping</p> <p>3- Explain why in blood transfusion, more importance is given to the recipient antibodies &amp; the donor RBCs?</p> <p>4- Describe the importance of cross-matching tests.</p> <p>5- How the ABO group considers as "universal recipient"&amp; group O as "universal donor "</p> <p>6- Describe the antibodies to D- antigen do normally present in plasma, under what condition they are developed?</p>
<p><b>Pathology</b></p>	
<p><b>1<sup>st</sup> Pathology lecture: RBCs disorders.</b></p> <p><b>Post hemorrhagic &amp; Hemolytic Anemias</b></p>	<ul style="list-style-type: none"> <li>* Describe the normal Adult reference ranges for red blood cells &amp; their indices.</li> <li>* Classify Anemias according to their             <ul style="list-style-type: none"> <li>(I) etiology</li> <li>(II) RBCs morphology</li> </ul> </li> <li>* Describe the main pathological, clinical manifestations &amp; consequences of anemia</li> <li>* Describe anemia of chronic blood loss</li> <li>* Describe the sequences &amp; effects of intravascular &amp; extravascular RBC destruction i.e hemolysis</li> <li>* Describe the definition, pathogenesis, characteristic clinical features. Blood film finding, diagnostic &amp; complications of Hereditary spherocytosis</li> </ul>
<p><b>2<sup>nd</sup> Pathology Lecture: Sickle cell disease, Thalassemia, G6PD deficiency</b></p>	<ul style="list-style-type: none"> <li>* Describe Sickle cell anemia, itiology, pathogenesis. The variables that influence sickling. Sickling consequences including microvascular obstruction &amp; hemolysis. Blood film &amp; bone marrow morphology. Clinical features, diagnosis &amp; complications</li> <li>* Define Thalassemia, classify it into alfa &amp; beta types</li> <li>* Discuss the etiology, pathogenesis &amp; diagnosis of alfa Thalassemia</li> <li>* Discuss the itiology, pathogenesis, peripheral blood &amp; bone marrow morphology in beta thalassemia. It's clinical manifestations &amp; complications.</li> <li>* Describe the causes, etiology, pathogenesis, type of inheritance, blood film finding &amp; diagnosis of G6PD deficiency</li> </ul>
<p><b>3<sup>rd</sup> Pathology Lecture: Iron Deficiency, Megaloblastic &amp; Aplastic anemias</b></p>	<ul style="list-style-type: none"> <li>* Describe the normal iron balance, Discuss the etiology, effects, BF&amp; BM morphology, clinical features &amp; diagnostic criteria for iron deficiency anemia</li> <li>* Describe the causes, pathogenesis, BF, BM morphology, clinical manifestations, diagnostic criteria &amp; complications of Megaloblastic anemia</li> <li>* Describe the etiology, pathogenesis, BF, BM,</li> </ul>

	features , clinical manifestations , diagnostic criteria, complications & prognosis of Aplastic anemia
<b>4<sup>th</sup> Pathology Lecture: Polycythemia</b>	<ul style="list-style-type: none"> <li>* Define polycythemia, mention the types, primary (polycythemia vera) &amp; secondary erythrocytosis. Etiology, and pathogenesis, clinical features</li> <li>* Describe the PB and bone marrow morphology</li> </ul>
<b>5<sup>th</sup> Pathology Lecture: Non-neoplastic disorders of WBCs</b>	<ul style="list-style-type: none"> <li>* Describe the etiology, pathogenesis, BM changes, clinical course &amp; complications of neutropenia /agranulocytosis</li> <li>* Enumerate the causes of leukocytosis</li> <li>* Describe the epidemiology, immunology, morphological features &amp;, clinical manifestation, diagnostic criteria &amp; complications of Infectious mononucleosis</li> <li>* Describe the etiology, gross &amp; microscopic patterns of acute &amp; chronic non-specific lymphadenitis</li> </ul>
<b>6<sup>th</sup> &amp; 7<sup>th</sup> Pathology lecture: Neoplastic proliferation of White blood cells. Lymphoid neoplasms: Precursor B&amp;T – cell lymphoblastic leukemia/lymphoma</b>	<ul style="list-style-type: none"> <li>* Enumerate the lymphoid, myeloid&amp; Histiocytic neoplasms of white cells. For lymphoid neoplasms Define : (1) the origin (B &amp;T –cells) (2) monoclonality (3) disruption of the normal immune regulatory mechanisms</li> <li>* Define the WHO classification of lymphoid neoplasms</li> <li>* Define leukemia and describe the FAB classification of leukemia, discuss the common features of each type including the pathophysiology, signs &amp; symptoms. Diagnosis of acute lymphoblastic leukemia (ALL) &amp; acute myelogenous leukemia (AML) using immunotyping &amp; karyotyping changes &amp; prognosis. lymphoblastic leukemia/lymphoma</li> <li>* Describe the incidence, pathophysiology morphology, immunophenotyping, karyotype, molecular features, clinical manifestation &amp; prognosis of each type</li> <li>(1) Small lymphocytic lymphoma (SLL), chronic lymphocytic leukemia (CLL) (2) Follicular lymphoma. (3) Mantle-zone lymphoma (4) Diffuse Large B-cell lymphoma (5) Burkitt's lymphoma</li> </ul>
<b>8<sup>th</sup> Pathology Lecture: Multiple myeloma &amp; related plasma cell disorders</b>	<ul style="list-style-type: none"> <li>* Multiple myeloma &amp; related plasma cell dyscrasias</li> <li>* Describe the common features, pathophysiology, morphologic features. Clinical manifestation, diagnosis &amp; prognosis of: (1) Localized plasmacytoma (2) Lymphoplasmacytic lymphoma &amp; Waldenstrom macroglobulinemia (3) Alfa heavy chain disease (4) Multiple myeloma</li> </ul>
<b>9<sup>th</sup> Pathology lecture: Hodgkin's lymphoma</b>	<ul style="list-style-type: none"> <li>* Classify Hodgkin's lymphoma, describe the etiology, pathogenesis, characteristic morphologic features, clinical staging of HL&amp;NHL (Ann Arbor classification)</li> <li>* Course, diagnosis &amp; prognosis of each type: (1) Nodular sclerosis (2) Mixed cellularity (3) Lymphocytic predominance</li> </ul>
<b>10<sup>th</sup> Pathology Lecture: Other lymphomas</b>	<ul style="list-style-type: none"> <li>* Define the etiology, main pathologic &amp; clinical features of:</li> </ul>

	<p>A- Extranodal marginal zone lymphoma (MLTOMa)</p> <p>B- Hairy cell leukemia</p> <p>C- Mycosis fungoides</p> <p>D- Peripheral T cell lymphoma</p>
<b>11<sup>th</sup> Pathology lectures: Bleeding disorders</b>	<p>* Describe the normal homeostatic response &amp; common laboratory tests in patients with bleeding disorders</p> <p>* Enumerate the causes of bleeding disorders: (1) Abnormalities of blood vessels (2) Deficiency of platelets (3) Derangement of blood clotting</p> <p>* Describe the etiology, pathogenesis, complications &amp; prognosis of Disseminated intravascular coagulation (DIC)</p> <p>* Define Thrombocytopenia, discuss the etiology, BM &amp; spleen morphology, diagnosis &amp; prognosis of Immune(idiopathic) thrombocytopenic purpura (ITP)</p> <p>* Thrombotic thrombocytopenic purpura (TTP) &amp; Hemolytic uremic syndrome (HUS)</p>
<b>12<sup>th</sup> Pathology lecture: Coagulation disorder, Splenomegally &amp; disorders of thymus</b>	<p>* Review the structure &amp; function of plasma factor VIII-VWF complex.</p> <p>* Describe the etiology, clinical features &amp; diagnosis of:</p> <p>(1) Von-Willbrand disease.</p> <p>(2) Factor VIII deficiency (HemophiliaA)</p> <p>(3) Factor IX deficiency (Christmas disease or Hemophilia B)</p> <p>* Enumerate causes of splenomegaly &amp; their effect</p> <p>* Define Thymic hyperplasia &amp; thymoma</p>
<b>Biochemistry</b>	
<b>1<sup>st</sup> Biochemistry Lecture: Erythrocytes Metabolism</b>	<p>Biochemistry of erythrocytes:</p> <ol style="list-style-type: none"> <li>1. Understand the hexose monophosphate pathway</li> <li>2. Understand the specificity of glucose utilization for energy production; anaerobic glycolysis</li> <li>3. List the biochemical abnormalities associated with hemolytic anemia</li> </ol>
<b>2<sup>nd</sup> Biochemistry lecture: Molecular biology of globin chain synthesis</b>	<ol style="list-style-type: none"> <li>1- Understand the organization of globin genes including <math>\beta</math> gene families</li> <li>2- Explain the synthesis of globin chain</li> <li>3- Explain the role of iron in Hb synthesis</li> <li>4- List the types of hemoglobin present in normal blood and what is the percentage of each type?</li> </ol>
<b>3<sup>rd</sup> Biochemistry Lecture: Hemoglobinopathies</b>	<ol style="list-style-type: none"> <li>1- Identify the structural abnormalities of sickle cell anemia (HbS), HbC disease (HbC) and HbSC disease (HbSC)</li> <li>2- Understand the principle behind hemoglobin electrophoresis as a diagnostic tool for hemoglobinopathies</li> <li>3- Describe the basic genetic defect for sickle cell disease and thalassemia</li> <li>4- Enzyme defects in porphyrias</li> </ol>
<b>4<sup>th</sup> Biochemistry Lecture:</b>	<ol style="list-style-type: none"> <li>1- Factors involved in blood coagulation</li> </ol>

<b>Biochemistry of coagulation</b>	2- Types of coagulation pathways
<b>Microbiology</b>	
<b>1<sup>st</sup> Microbiology Lecture: Salmonella Typhi, enteric fever &amp; Brucella</b>	For each organism: 1- Describe the morphology & the structure 2- Describe growth & toxins 3- Explain pathogenesis & clinical disease 4- Explain mode of transmission 5- Explain the clinical manifestations 6- Be familiar with laboratory diagnosis 7- Be familiar with treatment and prevention
<b>2<sup>nd</sup> Microbiology Lecture: Plasmodium and Babesiosis</b>	Describe the following: 1-Microscopical properties, classification & diseases. 2- Microscopic differences between species, life cycle, epidemiology & pathophysiology 3- clinical presentation, specimen collection, diagnosis, treatment & prevention
<b>3<sup>rd</sup> Microbiology Lecture: Yersinia pestis &amp; Plaque:Q- fever &amp; other Rickettsia</b>	For Yersinia pestis & Plaque: 1- Describe the general microbiological properties, differences from other Yersinia 2- Cultural techniques, epidemiology & pathophysiology 3- Clinical presentation, specimen collection for cultura, treatment & prevention. For Q- fever & other For Rickettsia, describe the following: 1-Microbial properties & diseases 2- Multiplication strategies, epidemiology & pathophysiology 3- Clinical presentation, specimen collection, laboratory diagnosis, treatment & prevention
<b>4<sup>th</sup> Microbiology Lecture: Trypanosomiasis, leishmaniasis and filariasis</b>	For each of Trypanosomiasis, Leishmaniasis & filariasis, describe the following: 1- Microbiological properties 2- Classification & diseases 3- Microscopical differences between species 4- Life cycle, epidemiology & specimen collection 5- Pathophysiology & clinical presentation 6- Diagnosis, treatment & prevention
<b>5<sup>th</sup> Microbiology Lecture: Epstein- Barr Virus (EBV) and Parvovirus</b>	1- Describe microbiological properties & diseases. 2-Multiplication strategies, epidemiology & pathophysiology 3- Clinical presentation, specimen collection, laboratory diagnosis, treatment & prevention
<b>Pharmacology</b>	
<b>1<sup>st</sup> &amp; 2<sup>nd</sup> Pharmacology lectures</b>	The pharmacology & uses of iron preparations, folic acid & vitamin B12
<b>4<sup>th</sup> &amp; 5<sup>th</sup> Pharmacology lectures: Anticoagulant &amp; Thrombolytic agents</b>	Discuss the pharmacology of anticoagulants (heparin, low molecular weight heparins & Warfarin) Discuss the pharmacology of thrombolytic agents (streptokinase, altepase) & antiplatelets drugs (Aspirin and ticlopidine)

	<p>List adverse effects, contraindications, drug interactions of the above drugs</p> <p>Realize their special indications in thromboembolism &amp; ischemic heart disease</p>
<b>6<sup>th</sup> &amp; 7<sup>th</sup> Pharmacology lectures: Drugs for treatment of lymphomas &amp; leukemias</b>	Discuss pharmacology, therapeutic uses & adverse effects
<b>8<sup>th</sup> Pharmacology Lecture: Immunopharmacology</b>	Discuss pharmacology, therapeutic & adverse
<b>Community Medicine</b>	
<b>1<sup>st</sup> Lecture: Blood born infection:</b>	<p>Classify blood born infection according to microorganism.</p> <p>Know the risk of blood born infection</p> <p>Detection and diagnosis of blood born infection</p> <p>Discuss method of management of blood born infection</p> <p>Discuss method of prevention of blood born infection</p>
<b>2<sup>nd</sup> Lecture: Anemia: a public health problem</b>	<p>Describe the worldwide prevalence of anemia.</p> <p>Define anemia</p> <p>Know Hemoglobin threshold</p> <p>List Factors responsible for high prevalence of anemia</p> <p>Classify anemia as a problem of public health significance</p> <p>Know the health consequences of anemia.</p> <p>Assessing anemia</p> <p>Know the control of anemia</p> <p>Correcting anemia</p> <p>Know maternal consequences of anemia</p>
<b>Practical Laboratory Sessions</b>	
<p><b>Anatomy Lab.</b></p> <p><b>1- Histology of blood smear</b></p> <p><b>2- Histology of lymphoid tissue</b></p>	<p>1- Review criteria for identifying neutrophils</p> <p>2- Examine the blood smear under the light microscope applying the above criteria to identify neutrophils</p> <p>3- Repeat the same process above in identifying red blood cells, basophils, acidophils, lymphocytes &amp; platelets</p> <p>4- Review criteria and distinguish histological features for identifying a lymph node</p> <p>5- Examine a cross section of a lymph node under the light microscope</p> <p>6- Repeat the same process above in identifying a cross section of a spleen, thymus &amp; tonsils</p>
<p><b>1<sup>st</sup> Physiology Lab.</b></p> <p><b>RBCs &amp; WBCs count</b></p> <p><b>PCV &amp; Blood grouping</b></p>	<p>1- Demonstration the methods of counting RBCs &amp; WBCs using the counting chambers</p> <p>2- Demonstration the PCV test using the microhematocrite</p> <p>3- Students are asked to find their own blood group &amp; the percentage of each blood group of the students attending the practical session</p>
<b>2<sup>nd</sup> Physiology Lab.</b>	1- Preparing & staining a blood film by the students



<b>WBCs &amp; differential count</b>	<p>2- Examination of the slide to be familiar with the identification of WBC type</p> <p>3- Count the percent of each type of WBC</p>
<b>1<sup>st</sup> Pathology Lab. Anemias &amp; Leukemias</b>	<p>Identify the morphologic abnormalities of peripheral blood &amp; bone marrow in:</p> <ol style="list-style-type: none"> <li>1- Iron deficiency anemia</li> <li>2- Megaloblastic anemia</li> <li>3- Thalassemia</li> <li>4- Sickle cell anemia</li> <li>5- Microangiopathic hemolytic anemia</li> <li>6- G6PD hemolytic anemia</li> <li>7- Hereditary spherocytosis</li> <li>8- Identify lymphoblasts, myeloblasts, promyelocytes &amp; Auer rods</li> </ol> <p>Identify the diagnostic microscopic changes of:</p> <ol style="list-style-type: none"> <li>1- Acute myeloid leukemia</li> <li>2- Acute lymphoblastic leukemia</li> <li>3- Chronic myelogenous leukemia</li> <li>4- Chronic lymphocytic leukemia</li> <li>5- Hairy cell leukemia</li> </ol>
<b>2<sup>nd</sup> Pathology Lab. Lymphadenitis &amp; Lymphomas</b>	<p>Identify the microscopic features of:</p> <ol style="list-style-type: none"> <li>1- Follicular hyperplasia</li> <li>2- Lymphadenitis, TB &amp; Cat scratch disease</li> <li>3- Follicular lymphoma</li> <li>4- Mantle cell lymphoma</li> <li>5- Small lymphocytic lymphoma</li> <li>6- Large cell lymphoma</li> <li>7- Hodgkin's lymphoma</li> </ol>
<b>Microbiology Lab. Blood culture techniques</b>	<ol style="list-style-type: none"> <li>1- Describe aseptic techniques used in blood culture</li> <li>2- Describe types of systems involved in the blood culture (automated &amp; manual)</li> <li>3- Describe different types and constituents of blood culture bottles</li> <li>4- Describe cultural and incubational environments</li> </ol>

### Teaching Methods and Assignments:

**Development of ILOs is promoted through the following teaching and learning methods:**

1. Textbook & references
2. Lecture notes

### Evaluation Methods:

#### Grading Policy:

Grades can be based on the following:

Mid Exam: 40%.

Practical Exam: 20%.  
Final Exam: 40%.  
Total Points: 100

### Course Policies:

#### **Attendance policies:**

If a student is absent for a teaching session then they must discuss this with the course instructor. If a student is absent for more than 25% of the course then he may be liable to fail the course

#### **B- Absences from exams and handing in assignments on time:**

If a student misses an examination then they will have the opportunity for a make-up examination, according to the university regulations.

#### **C- Health and safety procedures:**

College Members and students must at all times, conform to Health and Safety rules and procedures.

#### **D- Honesty policy regarding cheating, plagiarism, misbehavior:**

As a student in this course (and at this university) you are expected to maintain high degrees of professionalism, commitment to active learning and participation in this class and also integrity in your behavior in and out of the classroom. Students violate this policy would be subjected to disciplinary action according to the Hashemite University disciplinary policies

### References:

#### \* **Anatomy:**

- Principles of Human Anatomy. By G.J.Tortora, latest edition.
- Clinical Anatomy for Medical Students, By R.S. Snell, latest edition.
- Grant's Atlas of Anatomy or any other reasonable colored Atlas of Human Anatomy.
- Basic Histology. By L. Junqueira, latest edition.
- Before we are born. By K.L.Morre and T.V.N. Persaud, latest edition.

#### \* **Physiology:**

- Textbook of Medical Physiology. By Gytton and Hall, latest edition.

#### \* **Biochemistry:**

- Harper's Biochemistry. By Robert K. Murray and Co., latest edition.

#### \* **Pharmacology:**

- Lippincott's Illustrated Reviews: Pharmacology, latest edition.

#### \* **Pathology:**

- Robbin's Basic Pathology, By Kumar, Cotran and Robbin's, 9<sup>th</sup>. Edition 2013.
- Supplementary. Departmental Handouts.

**\* Microbiology:**

- Medical microbiology. An introduction to infectious diseases. By Sheries. Latest edition.

**Additional information:**

The semester is 5 weeks:

Anatomy: 5 Theory, 1 Practical

Physiology: 6 Theory, 2 Practical

Pathology: 12 Theory, 2 Practical

Microbiology: 5 Theory, 1 Practical

Biochemistry: 4 Theory, 1 Practical

Pharmacology: 9 Theory

Community: 2 Theory