Al-Balqa Applied University  
Faculty of Medicine

Course Title: Blood and Lymphatic System (BLS).  
Course Code: 31500371  
Credit Hours: 4 Credits  
Calendar Description: 4 weeks/ sem.2/ year 2  
Teaching approaches: integrated system course  
Course coordinator: Dr. Nabil Amer (MD, Ph.D.)

General Objectives:  
Upon completion of this course students should be able to:  
1. Describe the constituents of blood, their origin and function.  
2. Discuss the structure and function of the lymphoreticular system.  
3. Understand the basic classification systems of anemias, their laboratory and clinical features, public health aspects, and their management.  
4. Understand the of types of Hemoglobinopathies  
5. Understand the classification of neoplastic diseases of hematopoietic cells, methods for their diagnosis and their natural history and general guidelines for their management.  
6. Describe the regulatory mechanisms of normal hemostasis, abnormalities that lead to bleeding disorders, pathologic aspects that cause thrombotic disorders and how are these conditions treated?  
7. Describe blood borne pathogens with emphasis on morphological characterization and diagnosis.

II. Methods of Instruction:  
- Lectures.  
- Practical classes.  
- Video sessions  
- Small group discussions.

III. Evaluation and Distribution of Marks:  
- Written Midterm exam = 35%  
- Practical exam and case discussion evaluation at the end of the system = 15%.  
- Final end-system examination = 50%.

IV. Recommended Text Books and Atlases:  
* Anatomy:  
- 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. Carlos Junqueira, Latest Edition
* **Physiology:**

* **Biochemistry:**
  - Supplementary Departmental Handouts.

* **Pharmacology:**
  - Lippincott’s Illustrated Reviews: Pharmacology, Latest Edition

* **Pathology:**
  - Supplementary. Departmental handouts

* **Microbiology:**
  - JAWETZ MELNICK AND ADEL BOR G’S MEDICAL MICROBIOLOGY
  - Others:

* **Public Health (Community Medicine):**
  - Supplementary Departmental handouts.

**Learning (Specific) Objectives of the HLS:**

After studying the material covered in lectures, practical sessions, clinical seminars and after using his/her private self learning time in a productive way, the student is expected to achieve the following specific objectives:

**A. Lectures:**

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<tr>
<th>#</th>
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<th>Lecture Objectives</th>
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</table>
| 1 | Introduction to Hematopoietic system (multidisciplinary) | 1. Understand the general outline of the module.  
  2. Be familiar with the modalities of teaching throughout the course.  
  3. Acknowledge the important relation between normal and abnormal structure and function.  
  4. Appreciate the importance of basic sciences in clinical application. |
| 2 | Lymph circulation and drainage (Anatomy 1)         | 1. Understand the origin and composition of lymph.  
  2. Explain the circulation of lymph in the body. |
|   | Lymphoid Organs and tissue (Anatomy 2) | - Describe the gross anatomy and histology of the following lymphoid organs:  
1. Spleen, tonsils, thymus, lymph nodes and mucosa associated |
|---|---|---|
|   | Formed blood elements Peripheral blood (Anatomy 3) | 1. List blood components.  
2. Classify formed elements of blood.  
3. Discuss the scientific basis of the above classification.  
4. Describe the basic structure of erythrocytes and criteria of their identification.  
5. List the components of cellular granulocytes. |
|   | Blood: composition, function, blood volume & viscosity (Physiology 1) | 1. Describe the composition of blood.  
2. Understand the functions of blood.  
4. Understand the principle of linear blood flow. |
|   | Formed blood elements Bone Marrow I (Anatomy 4) | 1. Name organs responsible for hematopoiesis in the fetus.  
2. List the developmental stages of hematopoiesis both prenatally and postnatally. |
|   | Bone Marrow II (Erythropoiesis, Myelopoiesis & Thrombopoiesis) (Anatomy 5) | 1. Outline the major steps of post-natal development of blood formed elements (erythropoiesis, granulopoiesis, monocytopenesis and megakaryopoiesis.  
2. Identify characteristic features of these cells. |
|   | RBCs: Characteristics & functions (Physiology 2) | 1. Describe RBCs structure & its structure-function relationship.  
2. Understand the different functions of RBCs.  
3. Understand structure-function relationship of RBCs cell  
4. Identify the physiological factors that affect RBCs count.  
5. Understand the life span of RBCs & its relationship to blood donation |
|   | WBCs (Physiology 3) | 1. Recognize the different structural types of WBCs & their physiological functions.  
2. Define the life span & the physiological implication of WBC  
3. Differentiate between marginating & circulating pools of WBCs  
4. Understand the principle behind the total, |
| 10 | **Heme Metabolism**  
(Biochemistry1) | 1. Understand the importance of iron and its forms in heme.  
2. Describe mechanism and sites of heme destruction.  
3. List substances produced by heme destruction and their fate in the body.  
4. Understand the basic abnormalities that may result in heme catabolism. |
| --- | --- | --- |
| 11 | **Blood groups**  
(Physiology 4) | 1. Understand the principles of ABO blood group system.  
2. Understand the principles of Rh blood group system.  
3. Understand the principles of the HLA system. |
| 12 | **Anemias: classification and strategies for diagnosis**  
(Physiology 5) | 1. Name and describe the maturational sequence of erythroid cells in the bone marrow using the terms: proerythroblast, erythroblast, normoblast and reticulocyte.  
2. Discuss aplastic anemia with emphasis on its etiology, diagnostic criteria, clinical features and management.  
3. Discuss the role of erythropoietin in hematopoiesis with emphasis on its site of production and target cells.  
4. Classify anemias according to mean corpuscular volume (MCV) and give three examples of each type. |
| 13 | **Hemolytic anemia’s I**  
(Pathology 1) | 1. Describe parameters used to detect hemolysis.  
2. Classify hemolytic anemias.  
3. Describe immune processes leading to hemolysis with reference to diseases associated with hemolysis.  
4. Discuss the most frequent enzyme defects leading to hemolysis with emphasis on their clinical and laboratory findings.  
5. Identify: spherocyte, schistocyte, nucleated RBCs, Heinz bodies, elliptocyte and Howell-Jolly bodies. |
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<td>14</td>
<td>Hemolytic anemia’s II And Hemoglobinopathies (Pathology 2)</td>
<td>1. List the types of hemoglobin present in normal blood and what’s the percentage of each type? 2. For thalassemia syndromes describe the following: 3. Basic genetic defect 4. Red cell morphology 5. Clinical manifestations and complications 6. Diagnostic procedures</td>
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<tr>
<td>16</td>
<td>Drugs used in anemia’s (Pharmacology 1)</td>
<td>1. List the major forms of iron used in the therapy of anemias. 1. List the anemias for which iron supplementation is indicated and those for which it is contraindicated. 2. Describe the acute and chronic toxicity of iron describes the major hazards involved in the use of folic acid as sole therapy for megaloblastic anemia.</td>
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<td>17</td>
<td>Epidemiology, risk factors and prevention of Anemia (Community Medicine)</td>
<td>1. Understand Mortality and morbidity distribution of anemia (globally and locally). 2. Identify non-modifiable and modifiable anemia risk factors. 3. Describe the major nutritional risk factors in the determination of anemia. 4. Describe the different approaches in Anemia prevention</td>
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<td>18</td>
<td>General overview of hemostatic process (Physiology 5)</td>
<td>1. Understand the structure, function &amp; life span of platelets. 2. Understand the interaction of platelets, blood vessels and plasma coagulation factors in homeostasis. 3. Understand the role of the liver in normal homeostasis.</td>
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<td>19</td>
<td>Acute Leukemia’s (Pathology 3)</td>
<td>1. Understand the classification of acute leukemia’s with emphasis on the French American British (FAB) system. 2. Define the term “blast”. 3. Describe the normal phenotypic changes seen in differentiating B and T lymphocytes with reference to similar changes seen in acute</td>
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</table>
| 20 | **Salmonella typhi, enteric fever and Brucella** | lymphoblastic leukemia.  
4. Describe the clinical presentations, complications.  
5. Explain how the following tests are used in diagnosing acute leukemia’s:  
   i. Myeloperoxidase  
   ii. Non specific esterase  
   iii. TDT  
| 21 | **Chronic Myeloproliferative and myelodisplastic syndromes** | For each organism:  
1. Describe the morphology and the structure.  
2. Describe growth and toxins  
3. Explain pathogenesis and clinical disease  
4. Explain mode of transmissions.  
5. Explain the clinical manifestations.  
6. Be familiar with the laboratory diagnosis.  
7. Be familiar with treatment and prevention. |
| 22 | **Plasma proteins** | 1. Understand the clinical manifestations, laboratory findings and complications of Chronic Myeloproliferative and myelodisplastic syndromes  
2. Describe the morphologic characteristics of Chronic Myeloproliferative and myelodisplastic syndromes |
| 23 | **Yersinia pestis and plague** | 1. Explain albumin role as a carrier of bile acids and in transport of bilirubin, steroids and fatty acids.  
2. Describe the electrophoresis pattern for plasma proteins and its value as a diagnostic tool. |
| 24 | **Lymph Node Enlargement and Non- Hodgkin Lymphomas (NHL)** | 1. Describe the general characteristics of NHL, with reference to pathogenesis, classification and procedures used to diagnose them.  
2. Describe the grading systems of NHL.  
3. Compare the histopathologic, immunologic and clinical features of NHL.  
4. List three chromosomal translocations associated with NHL; describe the oncogenes associated with them. |
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<tr>
<th>25</th>
<th>Hodgkin Disease</th>
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| (Pathology 6) | 1. Describe the appearance of Reed-Sternberg cells and identify the significance of their presence.  
2. Define the meaning of “background” appearance of Hodgkin’s disease and how it is used in diagnosis and classification of this disease.  
3. Describe the staging system of Hodgkin disease.  
4. List the four types Hodgkin’s disease; describe their clinical presentations, general guidelines for patient evaluation and management. |

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<tr>
<th>26</th>
<th>Plasmodium and Babesiosis</th>
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| (Microbiology 3) | - Describe the following:  
1. Microbiological properties, classification and diseases.  
2. Microscopic differences between species, life cycle epidemiology, and pathophysiology.  
3. Clinical presentation, specimen collection, diagnosis, treatment, and prevention. |

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<tr>
<th>27</th>
<th>Anti-neoplastic drugs</th>
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| (Pharmacology 2) | 1. Recognize the general principles of cancer therapy.  
2. Understand the three main lines of cancer therapy.  
4. Understand the terms: adjuvant therapy, growth fraction and cell cycle.  
5. Understand the mode of drug action either phase-specific or non-specific.  
6. Classify cytotoxic drugs and explain their mechanism of action.  
7. Recognize the major adverse effects of cytotoxic drugs.  
8. List the common drugs, which have an immunosuppressive effect. |

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<tr>
<th>28</th>
<th>Physiology of blood coagulation</th>
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| (Physiology 6) | 1. Understand the process and stages (cascade) of blood coagulation and its significance.  
2. List and understand the role of factors involved in blood coagulation.  
3. Understand the role of serine proteases in the cascade of blood coagulation.  
4. Understand the intrinsic and extrinsic Pathways of blood clot  
5. Understand the cause of excessive bleeding  
6. Understand bleeding time, clotting time and prothrombine time |
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</table>
| 29   | Epstein Barr Virus (EBV) and Parvovirus B 19 (Microbiology 4) | Describe the following:  
1. Microbiological properties and diseases.  
3. Clinical presentation, specimen collection, laboratory diagnosis, treatment, and prevention. |
| 30   | Congenital Bleeding disorders (Pathology 7) | For each of von Willebrand disease, hemophilia A & B describe: heritance, etiology, clinical presentations & laboratory findings. |
| 31   | Inherited disorders of platelets function (Pathology 8) | 1. List the surface glycoproteins of platelets and define their roles.  
2. Describe the pathogenesis and laboratory findings of Bernard-Solier disease and thrombasthenia. |
| 32   | Q-Fever and other rickettsia (Microbiology 5) | Describe the following:  
1. Microbiological properties, classification and diseases.  
2. Microscopic differences between species, multiplication cycle, epidemiology, and pathophysiology.  
3. Clinical presentation, specimen collection, diagnosis, treatment, and prevention. |
| 33   | Porphyrins and biochemical basis of porphyria (Biochemistry 4) | 1. Explain the structure, biosynthesis and degradation of porphyrins and heme.  
2. List the enzymatic defects in the biosynthesis pathway that lead to porphyrias.  
3. Describe jaundice and bilirubin metabolic pathway defects.  
4. Understand bilirubin glucuronyl transferase enzyme and jaundice in newborns. |
| 34   | Idiopathic thrombocytopenic purpura (ITP) and thrombotic thrombocytopenic purpura (TTP) and DIC (Pathology 9) | 1. Describe the etiology, pathogenesis, clinical findings, laboratory results and patient management of adult and pediatric ITP.  
2. Identify the mechanism of neonatal and post transfusion thrombocytopenia.  
3. Describe the clinical findings and laboratory results of TTP.  
4. Understand the correct usage & significance of abnormalities of
| 35 | Drugs used in coagulation disorders | 1. Compare the antiplatelet drugs.  
2. List three different drugs used to treat disorders of excessive bleeding.  
3. Compare the oral anticoagulants with heparin in terms of their pharmacokinetics, mechanisms, and toxicities.  
4. Compare the thrombolytic preparations |
|---|---|---|
| 36 | Plasma cell tumors and monoclonal gammopathies | Understand the clinical manifestations, laboratory findings and complications of plasma cell tumors.  
- Define:  
  1. Bence Jones proteins  
  2. Monoclonal spike  
  3. M proteins  
  4. Heavy chain disease.  
  5. Waldenstrom's macroglobulinemia. |
| 37 | Trypanosomiasis, visceral leishmaniasis and Filariasis I | - For each of Trypanosomiasis, leishmaniasis and filariasis,  
- Describe the following:  
  1. Microbiological properties.  
  2. Classification and diseases.  
  3. Microscopic differences between species.  
  4. Life cycle epidemiology and specimen collection.  
  5. Pathophysiology and clinical presentation.  
  6. Diagnosis, treatment, and prevention. |
| 38 | Trypanosomiasis, visceral leishmaniasis and Filariasis II | - For each of Trypanosomiasis, leishmaniasis and filariasis, describe the following:  
  7. Microbiological properties.  
  8. Classification and diseases.  
  9. Microscopic differences between species.  
  10. Life cycle epidemiology and specimen collection.  
  11. Pathophysiology and clinical presentation.  
  12. Diagnosis, treatment, and prevention. |
**B - Practical Laboratory Sessions:**

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<th>Lab #</th>
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<th>Objectives</th>
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| 1     | Anatomy and Histology of lymphoid organs and tissue  | 1. Identify the anatomical location and characteristics of the lymphoid organ and tissue  
       | Histology of blood elements                           | 2. Identify the distribution of lymph ganglia (groups)  
       | (Anatomy)                                             | 3. Lymph vessels histology and distribution  
       |                                                       | 4. Thoracic duct  
       |                                                       | 5. Review criteria for identifying neutrophils.  
       |                                                       | 6. Examine a blood smear under the light microscope applying the above criteria to decide which cell is a neutrophil.  
       |                                                       | 7. Repeat the same process above in identifying other blood cells: basophils, acidophils, lymphocytes, platelets and RBCs.  
       |                                                       | 8. Review criteria and distinguishing histological features for identifying a lymph node.  
       |                                                       | 9. Examine a cross section of lymph node under the light microscope applying the above criteria.  
       |                                                       | 10. Repeat the same process above in identifying and examining cross sections of the spleen, thymus, tonsils and Mucosa Associated Lymphoid Tissues (MALT). |
| 2     | RBCs & WBCs count Hb, PCV, RBCs, WBCs, differential blood grouping, bleeding and clotting time | **Introduce the student to the hematology lab.**  
       | (Physiology)                                          | 1. Learn the basic techniques used in counting & the clinical implication of this count.  
       |                                                       | 2. Learn the basic techniques in doing RBCs & WBCs count Hb, PCV, RBCs, WBCs, differential blood grouping, bleeding and clotting time Understand how to calculate RBCs values & their clinical significance  
       |                                                       | 3. Learn the basic techniques of WBCs and differential count.  
       |                                                       | 4. Understand total leukocytic count, the differential leukocytic count & their clinical significance. |
C. Group Discussion Topic:

1. Anemia.

### Summary of the Teaching Activities in the Module

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<th>Department</th>
<th>No of Lectures</th>
<th>No of Labs</th>
<th>Small group discussion</th>
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<tr>
<td>Anatomy</td>
<td>6</td>
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<tr>
<td>Physiology</td>
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<tr>
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<tr>
<td>Microbiology</td>
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<tr>
<td>Pharmacology</td>
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