

In the name of Allah  
**Medical Immunology Course plan**

**Part A:**

<b>Education year:</b> 2025-2026 or 1404-1405	<b>Semester:</b> First	<b>Lesson name:</b> Medical Immunology
Educational department: Medical Immunology	<b>Lesson type:</b> Basic	<b>Prerequisite lessons:</b> None
<b>Field:</b> Medicine	<b>Step:</b> Basic Science	<b>Day and time of class:</b> (Theoretical) Monday: 14-16 - (Practical) Saturdays, 12:00-14:00, Tuesdays 8:00-10:00 & Wednesdays 10:00-12:00
<b>Class number:</b> (Theoretical) Pardis in "Yas" Block - (Practical) Afzali Pour Faculty of Medicine, in Immunology laboratory	<b>In charge professor:</b> Dr. Mohammad Mahdi Mohammadi	

**Part B:**

General objectives of the lesson:

Theoretical Topics	Specific objectives	Developmental evaluation method		Teaching method (Based on model-small group-Problem Based Learning (PBL)-Team Based Learning (TBL)-speech)		Educational tools	Comprehensive assignments	Teaching sources
		method	percent	method	percent			
Introduction to the Immune System Basic Concepts & Components of the Immune System	The student should be able to: 1. Define immunity and distinguish between innate and adaptive immunity in terms of receptors, specificity, memory, and response time. 2. List the major cellular (e.g., phagocytes, lymphocytes) and molecular (e.g., antibodies, cytokines) components of the innate and adaptive immune systems. 3. Describe the fundamental characteristics of adaptive immunity: specificity, diversity, memory, and self/non-self discrimination. 4. Differentiate between the effector mechanisms and primary functions of humoral (antibody-mediated) and cell-mediated (T-cell-mediated) immunity. 5. Explain the concept of clonal selection as the central principle governing the specificity and expansion of adaptive immune responses	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Introduction to Antigen Recognition Hematopoiesis	The student should be able to: 1. Outline the process of hematopoiesis, identifying the pluripotent hematopoietic stem cell and the major lineages giving rise to myeloid and lymphoid cells. 2. Define the term "antigen" and distinguish it from an "epitope." 3. Compare and contrast the structure and function of the key antigen recognition receptors: B-cell receptors (BCR/antibody) and T-cell receptors (TCR). 4. Explain the critical difference in antigen recognition between B cells (native, soluble antigen) and T cells (processed peptide presented by MHC molecules). 5. Describe the general structure of an immunoglobulin domain and its significance in forming antigen-binding sites.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Antigens & Antibody Structure Antigen & Antibody Interaction	The student should be able to: 1. Diagram the basic structure of an IgG molecule, labeling the heavy and light chains, variable and constant regions, Fab and Fc fragments, and the antigen-binding site. 2. List the five major classes of immunoglobulins (IgG, IgM, IgA, IgD, IgE) and summarize their unique structural features and primary biological functions. 3. Define affinity and avidity in the context of antibody-antigen binding and explain how multivalent interactions increase the strength of binding. 4. Describe the principles behind common serological tests (e.g., agglutination, precipitation, ELISA) that exploit antibody-antigen interactions. 5. Predict how the physicochemical properties of an antigen (e.g., size, complexity, foreignness) influence its immunogenicity.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Antibody Diversity	The student should be able to: 1. State the central genetic problem of generating a vast antibody repertoire from a limited number of genes.	Practice Reports Lab	40 30 30	Lecture questions	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students

	<p>2.Explain the mechanism of somatic recombination, listing the key gene segments (V, D, J) involved in generating the variable region of immunoglobulin heavy and light chains.</p> <p>3.Describe how junctional diversity (imprecise joining and N-nucleotide addition) significantly contributes to the antibody repertoire.</p> <p>4.Define the processes of allelic exclusion and its importance in ensuring B cell clonality.</p> <p>5.Contrast the generation of the primary (germline) antibody repertoire with the secondary repertoire shaped by somatic hypermutation and affinity maturation.</p>	attendance written exam		and answers				(Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Constitutive Defenses Including Complement	<p>The student should be able to:</p> <ol style="list-style-type: none"> <li>List the major physical (e.g., skin, mucous membranes), chemical (e.g., defensins, lysozyme), and biological (e.g., normal flora) barriers of innate immunity.</li> <li>Diagram the three pathways of complement activation (classical, lectin, and alternative), highlighting their unique triggers and initial components.</li> <li>Explain the three primary effector functions of the complement system: opsonization (C3b), inflammation (C3a, C5a), and cell lysis (MAC).</li> <li>Describe the critical role of regulatory proteins (e.g., C1 inhibitor, Factor H, DAF) in preventing inappropriate complement activation on host tissues.</li> <li>Integrate the complement system as a key bridge between innate and adaptive immunity.</li> </ol>	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Phagocytes Killing in the Immune System Inflammation	<p>The student should be able to:</p> <ol style="list-style-type: none"> <li>Identify the major phagocytic cells (neutrophils, macrophages) and describe the sequential steps of phagocytosis: chemotaxis, adherence, ingestion, and phagolysosome formation.</li> <li>Compare and contrast the oxygen-dependent (reactive oxygen species) and oxygen-independent (lysozyme, defensins) mechanisms of intracellular microbial killing.</li> <li>Define the cardinal signs of inflammation and explain the underlying vascular (vasodilation, increased permeability) and cellular (leukocyte migration) events.</li> <li>Outline the process of leukocyte extravasation, naming the key adhesion molecules (selectins, integrins) and chemoattractants involved.</li> <li>Describe the role of Natural Killer (NK) cells in recognizing and killing virus-infected and tumor cells, emphasizing the "missing-self" hypothesis.</li> </ol>	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Organs & Tissues of the Immune System B-Cell Development- A Review	<p>The student should be able to:</p> <ol style="list-style-type: none"> <li>Classify the primary (bone marrow, thymus) and secondary (spleen, lymph nodes, MALT) lymphoid organs and summarize their primary functions in lymphocyte development and immune response initiation.</li> <li>Trace the development of a B-cell from a pro-B cell to a naive, immunocompetent B cell in the bone marrow, highlighting the critical checkpoints (successful Ig gene rearrangement).</li> <li>Explain the process of negative selection and its role in establishing central B-cell tolerance.</li> <li>Describe the structure and function of the B-cell co-receptor complex (CD19, CD21, CD81) and its role in amplifying activation signals.</li> <li>Predict the consequences of failures in B-cell development, leading to immunodeficiencies or autoimmunity.</li> </ol>	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Major Histocompatibility Complex Antigen Processing & Presentation	<p>The student should be able to:</p> <ol style="list-style-type: none"> <li>Describe the genetic organization of the Major Histocompatibility Complex (MHC) and the polymorphic nature of HLA genes.</li> <li>Compare and contrast the structure, cellular distribution, and source of protein antigens for MHC class I and MHC class II molecules.</li> <li>Outline the pathways of antigen processing and presentation: the cytosolic pathway for MHC-I (endogenous antigens) and the endocytic pathway for MHC-II (exogenous antigens).</li> <li>Explain the role of the peptide-loading complex and the invariant chain (Ii) in guiding MHC-II molecule assembly and preventing premature peptide binding.</li> <li>Explain the clinical relevance of MHC in organ transplantation (tissue matching) and its association with autoimmune diseases.</li> </ol>	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
The T-Cell Receptor Review of Antigen Recognition Lymphocyte Activation	<p>The student should be able to:</p> <ol style="list-style-type: none"> <li>Trace the development of a T-cell in the thymus, including the critical checkpoints of positive selection (for MHC restriction) and negative selection (for self-tolerance).</li> <li>Distinguish the effector functions and surface markers of the major T-helper subsets (Th1, Th2, Th17) and cytotoxic T lymphocytes (CTLs).</li> <li>Explain the central role of the T-follicular helper (Tfh) cell in providing help to B cells for antibody production in germinal centers.</li> <li>Define immunological memory and contrast the properties of naive, effector, and memory T and B cells.</li> <li>Classify key cytokines (e.g., IL-2, IFN-<math>\gamma</math>, IL-4, IL-17) based on their primary source and major functions in directing immune responses.</li> </ol>	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
T-Cell Development T-Cell Interactions T-Cell Help Immunologic Memory & Homeostasis	<p>The student should be able to:</p> <ol style="list-style-type: none"> <li>Describe the structure of the T-cell receptor (TCR) and its associated CD3 complex, explaining the role of CD3 in signal transduction.</li> <li>Explain the concept of MHC restriction as it applies to T-cell recognition of antigen.</li> <li>Define the "two-signal model" for naive lymphocyte activation, identifying Signal 1 (TCR:MHC-peptide), Signal 2 (co-stimulation, e.g., CD28:B7), and the consequence of signal 1 in the absence of signal 2 (anergy).</li> </ol>	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Nairn) 2017 Basic Immunology by: Abbas,

Cytokines in the Immune System	4. Outline the intracellular signaling cascade initiated by TCR engagement, leading to T-cell proliferation and differentiation. 5. Contrast the activation requirements of naive T-cells with those of effector and memory T-cells.							Lichtman, Pillai (6th edition, 2020)
Regulation of the Immune System Brief Review of Immune Physiology	The student should be able to: 1.Explain the central role of regulatory T cells (Tregs), particularly those expressing FoxP3, in maintaining peripheral tolerance and preventing autoimmunity. 2.Describe other mechanisms of peripheral tolerance, including anergy, deletion, and immune privilege. 3.Summarize how the immune response is self-limiting through mechanisms such as activation-induced cell death (AICD) and cytokine-mediated suppression. 4.Integrate the roles of innate and adaptive immunity in a coordinated response to a hypothetical pathogen, from initial infection to resolution and memory. 5.Predict potential clinical outcomes (e.g., autoimmunity, chronic inflammation, immunodeficiency) that may arise from dysregulation at various control points in the immune system.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Naim) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Infections & vaccines	The student should be able to: 1.Provide examples of how different pathogens (extracellular bacteria, intracellular bacteria, viruses, parasites) are countered by distinct effector arms of the immune system. 2.Explain the concept of herd immunity and its critical importance in public health. 3.Compare and contrast the different types of vaccines (e.g., live attenuated, killed/inactivated, subunit, conjugate, mRNA) in terms of their composition, mechanism of action, and advantages/disadvantages. 4.Describe the principle of passive vs. active immunization, providing clinical examples for each. 5.Discuss the immunological basis for vaccination schedules, including the need for primary series and booster shots.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Immunology for medical students (Helbert - Naim) 2017 Basic Immunology by: Abbas, Lichtman, Pillai (6th edition, 2020)
Practical Topics	Specific objectives	Developmental evaluation method	Teaching method (Based on model-small group- Problem Based Learning (PBL)- Team Based Learning (TBL)- speech)		Educational tools	Comprehensive assignments	Teaching sources	
			method	percent				method
Introduction to Immunoserology, Ag-Ab interactions	1.The student should be able to follow safety and hygiene principles in the immunology laboratory. 2.The student can identify and perform basic use of main laboratory instruments. 3.The student should be able to describe different types of biological samples and their storage conditions. 4.The student can perform basic calculations and dilutions in serological tests. 5.The student should be able to explain the basic principles of recording and reporting laboratory results.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides
Blood grouping (ABO, Rh)	1.The student can perform ABO and Rh blood grouping tests. 2.The student should be able to distinguish between positive and negative agglutination reactions. 3.The student can interpret and report blood grouping results. 4.The student should be able to explain the antisera used in the test and their roles. 5.The student can identify sources of error in blood grouping tests.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides
Cross match, Direct/Indirect Coombs	The student should be able to: 1. State the crossmatch's goal: detecting recipient antibodies that cause transfusion reactions. 2.Correctly perform the serial steps of a standard tube-based crossmatch. 3.Interpret agglutination and hemolysis to determine compatibility. 4.Explain the crossmatch's role as the final pre-transfusion safety check. 5.Predict consequences of an incompatible result and the correct procedural response. 6.The student should be able to perform the Direct Coombs Test (DCT). 7.The student can execute the Indirect Coombs Test (IAT). 8.The student should be able to interpret positive and negative results in both Coombs tests. 9.The student can state the clinical applications of the Coombs test. 10.The student should be able to analyze causes of false positive and false negative results	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides
CRP, RF, Anti-CCP Antibodies	1.The student can perform the CRP test using the latex agglutination method. 2.The student should be able to interpret positive and negative CRP results. 3.The student can compare the differences between CRP and ESR. 4.The student should be able to state the clinical applications of the CRP test. 5.The student can become familiar with the principles of quantitative CRP methods 6.The student can perform the Rheumatoid Factor (RF) test.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides

	7.The student should be able to interpret positive and negative RF results. 8.The student can compare the differences between RF and Anti-CCP. 9.The student should be able to identify conditions associated with false positive RF results. 10.The student can describe the role of RF in the pathogenesis of rheumatoid arthritis.							
RPR & VDRL, Antiphospholipid Antibodies	1.The student can perform VDRL and RPR tests. 2.The student should be able to interpret positive, negative, and weakly positive results. 3.The student should be able to explain confirmatory treponemal tests and their differences from VDRL/RPR. 4.The student can identify causes of false positive results.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides
Wright (Slide, Tube), Coombs Wright & 2ME	1.The student should be able to perform the Wright test for the serological diagnosis of brucellosis. 2.The student can interpret the antibody titer in the Wright test. 3.The student should be able to identify the agglutination reaction. 4.The student can become familiar with different methods of performing the Wright test. 5.The student should be able to identify the limitations of the Wright test.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides
ELISA Technique	1.The student should be able to explain the basic principles of the ELISA method and its types. 2.The student can perform an ELISA test for a specific marker. 3.The student should be able to interpret ELISA results based on optical density and cut-off values. 4.The student can list the applications of ELISA in diagnosing infectious, autoimmune, and cancerous diseases 5. The student should be able to explain factors affecting ELISA result quality and the importance of quality control.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides
Precipitation, Ouchterlony, SRID	The student should be able to: 1.Explain the SRID principle: antigen diffusion in antibody-gel forms quantifiable rings. 2.Correctly load standard and patient samples into an SRID plate. 3.Measure ring diameters and use a standard curve to find unknown concentration. 4.Identify SRID's clinical use in diagnosing immunodeficiencies and paraproteinemia's. 5.Discuss key variables affecting the assay, like incubation time and temperature.	Practice Reports Lab attendance written exam	40 30 30	Lecture questions and answers	60 40	lecture using whiteboard and PowerPoints	questions and answers and Discussion	Pre-Lab P.P.T. Slides

## Part C:

- ✓ Specific objectives (based on three areas of educational objectives: Cognitive, Emotional, Psychomotor)
- ✓ The general objectives will actually represent the main objectives of that teaching session, which are divided into several specific behavioral objectives.
- ✓ Specific behavioral objectives contain behavioral verbs, criteria, content and conditions and are designed in cognitive, emotional and psychomotor areas. These objectives are effective in determining teaching methods and tools.

## Final evaluation:

Developmental evaluation (midterm exam, quiz, questions and answers, ethical and professional Behavior, class activity); **40%**

Final exam evaluation; **60%**