Ministry of Higher Education and Scientific Research
Apparatus for Supervision and Scientific Evaluation

Warith Al-Anbiyaa University (AS)
College of Medicine

Academic Program Description Form for Institutes and Colleges 2026-2027

Course Syllabus

Academic Program Description Form

University Name:	Warith Al-Anbiyaa University
College/Institute:	College of Medicine — Warith Al-Anbiyaa University (AS)
Scientific Department:	College of Medicine
Academic or Professional Program Name:	Biochemistry and Medical Chemistry
Final Certificate Name:	Bachelor of Medicine and Surgery (M.B.Ch.B)
Study System:	Annual
Date of Preparing the Description:	5 September 2026
Date of Filling the Form:	5 September 2026

Signature:

Head of Department Name: Dr. Riadh Abdulrasool Hameed Hnewa

Date:

Signature:

Scientific Assistant Name: Dr. Ali Abulrida Algourah

Date:

Reviewed by

Quality Assurance and University Performance Division

Name of Director of Quality Assurance and University Performance Division: Dr. Ayad Ali Sahib Al Mousawi

Date: 14.9.2026 13/09/2026

Signature:

Approved by the Dean

prof. Ali A-Saadoon

Course Description Form

1. Course Title
Biochemistry and Medical Chemistry
2. Course Code
Med101
3. Semester / Academic Year
Annual
4. Date This Description Was Prepared
5 September 2026
5. Available Modes of Attendance
In-person and online
6. Total Credit Hours / Total Units
60 theoretical hours + 60 practical hours (6 units)
7. Course Coordinator(s), if more than one
Name: Dr. Riadh Abdulrasool Hameed Hnewa Email: riadh.ab@uowa.edu.iq

8. Course Objectives

Introduce students to the chemical composition of the human body and the changes that occur under normal and pathological conditions.
Conduct laboratory experiments on selected normal body constituents, together with simple tests used to detect certain pathological conditions.
Relate biochemical laboratory findings to disease diagnosis.
Establish a sound scientific foundation demonstrating that chemistry underpins the medical sciences; train students to use laboratory instruments and equipment appropriately; introduce basic principles of other diagnostic laboratories; highlight the role of biochemistry in supporting other specialties; encourage students' scientific activity in chemistry; and motivate physicians to pursue postgraduate study in this field.

Course Learning Objectives

A. Knowledge and Understanding
A1. Acquire fundamental knowledge of biochemistry.
A2. Develop broad knowledge and understanding of the different types of metabolic processes and biochemical changes.

A3. Develop information-retrieval skills.
A4. Encourage and train students to deal appropriately with scientific facts relevant to this field.
A5. Encourage students to draw conclusions, interpret results, and present and discuss their findings.

B. Program-Specific Practical Skills
B1. Apply scientific knowledge in the field of biochemistry.
B2. Identify the different types of metabolic processes and biochemical changes.
B3. Select and use chemical laboratory tests appropriately in the diagnosis of different diseases.
B4. Understand the methods used to perform chemical analyses.
B5. Understand chemical analyses and the interactions among them.

C. Affective and Ethical

Objectives

C1. Maintain the confidentiality of patients' personal information.
C2. Ensure that patients receive the laboratory tests they need.
C3. Demonstrate honesty and professional integrity, without allowing financial gain to compromise the ethical standards of the profession.

9. Teaching and Learning Strategies

Strategies:

1. An integrated curriculum combining theoretical and practical instruction.
2. Lectures and interactive classroom discussion.
3. Scientific activities and research.
4. Academic partnerships and institutional education.
5. Delivery of theoretical lectures using available presentation technologies, including projectors and smart boards.
6. Use of e-learning in the laboratory.
7. Instructions and guidance concerning the conduct and objectives of the medical profession.
8. Field observation of practical methods for interacting with patients in clinical settings.
9. Educational films and videos addressing affective and ethical objectives.

Syllabus of 1st year			
Week	**Subject**	**Objective**	
1W	Chemistry& metabolism of CHO	Carbohydrate Chemistry – Learning Objectives **Define carbohydrates** and classify them based on: ○ Number of carbon atoms (triose, tetrose, etc.) ○ Functional group (aldose, ketose) ○ Complexity (monosaccharides, disaccharides, oligosaccharides, polysaccharides)	LEC 1 & 2

2W	**Chemistry & metabolism of CHO**	**Describe the structure and functions** of key monosaccharides (glucose, fructose, galactose). **Explain the concept of isomerism** in carbohydrates: • Structural isomers • Stereoisomers (D- and L-forms) • Epimers and anomers	LEC 3&4
3W	**Chemistry & metabolism of CHO**	**Discuss the structure and biological importance** of major disaccharides and polysaccharides: ○ Disaccharides: sucrose, lactose, maltose ○ Polysaccharides: starch, glycogen, cellulose **Describe common chemical reactions** of carbohydrates: ○ Oxidation and reduction ○ Glycosidic bond formation ○ Benedict's and Barfoed's tests	LEC 5&6
4W	**Chemistry & metabolism of CHO**	Carbohydrate Metabolism – Learning Objectives **Outline the major pathways** of carbohydrate metabolism: ○ Glycolysis ○ Gluconeogenesis ○ Glycogenolysis and Glycogenesis ○ Pentose Phosphate Pathway (PPP) **Describe the steps of glycolysis**, including: ○ Key enzymes ○ Energy yield (ATP and NADH) ○ Regulatory points **Explain the role of the TCA cycle** and its integration with glycolysis.	LEC 7&8
5W	**Chemistry & metabolism of CHO**	• **Discuss the regulation of blood glucose**: • Hormonal control (insulin and glucagon) • Fed vs. fasting state • Understand **the Cori cycle** and its significance in anaerobic metabolism. • **Describe glycogen metabolism**, including: • Enzymes involved	LEC 9&10

		• Regulation by hormones	
6W	**Chemistry & metabolism of CHO**	• Fructose intolerance • Apply **knowledge to clinical conditions**, such as: • Diabetes mellitus • Hypoglycaemia • Metabolic acidosis	LEC 11&12
7W	**Chemistry & metabolism of Amino acid**	Amino Acid Chemistry – Learning Objectives **Define amino acids** and describe their general structure: ○ Amino group, carboxyl group, side chain (R group), central carbon **Classify amino acids** based on: ○ Polarity (non-polar, polar, acidic, basic) ○ Nutritional requirement (essential vs non-essential) ○ Metabolic fate (glucogenic, ketogenic, or both) ○ Optical activity (D- and L- forms) **Understand peptide bond formation**: ○ Structure of dipeptides and polypeptides ○ Role in protein primary structure ○ Role in protein 2nd structure ○ Role in protein 3rd structure ○ Role in protein 4th structure	LEC 13&14
8W	**Chemistry & metabolism of Proteins**	Amino Acid Metabolism – Learning Objectives **Explain the digestion and absorption** of dietary proteins: ○ Enzymes involved (pepsin, trypsin, etc.) ○ Amino acid transport systems **Describe amino acid catabolism**, including: ○ Transamination ○ Deamination	LEC 15&16

		○ Ammonia formation and detoxification **Understand the urea cycle**: ○ Key steps and enzymes ○ Role in nitrogen excretion ○ Clinical relevance (e.g. hyperammonemia) **Outline the fate of carbon skeletons** of amino acids: ○ Entry into TCA cycle, gluconeogenesis, or ketogenesis **Describe the biosynthesis** of non-essential amino acids **Identify common inborn errors of amino acid metabolism**: ○ Phenylketonuria (PKU) ○ Alkaptonuria ○ Maple syrup urine disease ○ Homocystinuria **Apply biochemical principles** to clinical situations: ○ Malnutrition (Kwashiorkor, Marasmus) ○ Protein-energy deficiency ○ Aminoaciduria	
9W	**Chemistry of Enzymes (I)**	Enzyme Chemistry – Learning Objectives **Define enzymes** and describe their general characteristics: ○ Biological catalysts ○ Specificity and efficiency ○ Reusability **Classify enzymes** based on the type of reactions they catalyze: ○ Oxidoreductases, Transferases, Hydrolases, Lyases, Isomerases, Ligases	LEC 17&18

		Describe enzyme structure and components: ○ Apoenzyme and cofactor (holoenzyme) ○ Coenzymes and prosthetic groups ○ Active site and substrate binding **Explain enzyme kinetics:** ○ Michaelis-Menten equation ○ Definitions of Km and Vmax ○ Factors affecting enzyme activity: temperature, pH, substrate concentration **Discuss enzyme inhibition:** ○ Competitive vs non-competitive inhibition ○ Reversible and irreversible inhibition ○ Clinical relevance (e.g., drug action) **Describe enzyme regulation mechanisms:** ○ Allosteric regulation ○ Feedback inhibition ○ Covalent modification (e.g., phosphorylation) **Understand the concept of Isoenzymes (isozymes):** ○ Clinical significance (e.g., LDH, CK in myocardial infarction)	
10W	**Chemistry of Enzymes (II)**	Enzymes in Clinical Diagnosis **Describe the diagnostic importance of liver enzymes:** ○ **ALT (SGPT), AST (SGOT):** hepatocellular damage ○ **ALP, GGT:** cholestasis, biliary obstruction **Understand the significance of pancreatic enzymes:** ○ **Amylase** and **Lipase** in acute pancreatitis	LEC 19&20

		Describe the cardiac enzymes and biomarkers: ○ **CK-MB, LDH isoenzymes, Troponins (I, T)** for myocardial infarction ○ Timeline of enzyme release and peak activity post-infarction **Understand the role of enzymes in muscle disorders:** ○ **Creatine kinase (CK/CPK)** in muscular dystrophy, rhabdomyolysis **Interpret renal function-related enzymes** (limited role, e.g., GGT in renal tubular function)	
		Special Enzymes and Conditions **Describe enzymes used in bone disorders:** ○ **Alkaline phosphatase (ALP)** in Paget's disease, bone metastasis **Recognize enzyme patterns in hemolysis:** • **LDH** and indirect bilirubin rise **Understand enzyme changes in malignancies:** • Tumour markers (e.g., PSA as a serine protease)	
11W	**Chemistry of Hormones**	a. Definition of Hormones b. Classification of Hormones c. Mechanisms of Action of Hormones and Signalling Molecules d. Second Messengers and G-proteins	LEC 21&22
12W			LEC 23&24
13W	**Chemistry & metabolism of Lipids (I)**	Lipid Chemistry – Learning Objectives **Define lipids** and describe their general characteristics: ○ Hydrophobic or amphipathic molecules ○ Solubility in organic solvents **Classify lipids** into major groups: ○ Simple lipids (e.g., triglycerides)	LEC 25&26

		○ Compound lipids (e.g., phospholipids, glycolipids) ○ Derived lipids (e.g., cholesterol, fatty acids) **Describe the structure and function** of: ○ Fatty acids (saturated vs unsaturated) ○ Triglycerides ○ Phospholipids and glycolipids ○ Cholesterol and its derivatives	
14W	**Chemistry & metabolism of Lipids (II)**	• **Understand essential fatty acids**: • Linoleic acid, α-linolenic acid • Their role in membrane structure and eicosanoid synthesis • **Explain the physical and chemical properties** of lipids: • Saponification • Hydrogenation • Iodine number (unsaturation level) • **Recognize the biological functions of lipids**: • Energy storage • Structural component of membranes • Precursors to hormones and signalling molecules	LEC 27&28
15W	**Chemistry& metabolism of Lipids (II)**	Lipid Metabolism – Learning Objectives **Describe digestion and absorption of dietary lipids**: ○ Role of bile salts and pancreatic lipase ○ Formation and transport via chylomicrons **Understand the β-oxidation of fatty acids**: ○ Steps and location (mitochondria) ○ Energy yield ○ Carnitine shuttle system	LEC 29&30

		Explain fatty acid synthesis: ○ Occurs in the cytosol ○ Key enzyme: fatty acid synthase ○ Role of acetyl-CoA and NADPH **Discuss the metabolism of triglycerides:** ○ Lipolysis and re-esterification ○ Hormonal regulation (insulin, glucagon, epinephrine)	
16W	**Chemistry & metabolism of Lipids (II)**	• **Understand the biosynthesis and function of ketone bodies:** • Ketogenesis and ketolysis • Conditions where ketones are produced (fasting, diabetes) • **Explain cholesterol metabolism:** • Biosynthesis pathway (HMG-CoA reductase) • Regulation and feedback inhibition • Role in steroid hormone and bile acid synthesis • **Describe the structure and function of lipoproteins:** • Chylomicrons, VLDL, LDL, HDL • Role in lipid transport • Clinical importance of LDL and HDL • **Recognize lipid-related disorders:** • Hyperlipidaemia • Atherosclerosis • Fatty liver disease • Inborn errors (e.g., Tay-Sachs, Gaucher's) • **Relate lipid metabolism to clinical conditions:** • Obesity • Diabetes mellitus • Cardiovascular diseases	LEC 31&32
17W	**Chemistry of Vitamins and Coenzymes trace elements**	Vitamin Chemistry & Metabolism – Learning Objectives ◆ General Concepts	LEC 33&34

		Define vitamins and understand their general classification: ○ Fat-soluble (A, D, E, K) ○ Water-soluble (B-complex and C) **Differentiate between fat-soluble and water-soluble vitamins** based on: ○ Absorption and storage ○ Risk of deficiency vs toxicity	
		Fat-Soluble Vitamins **Describe the chemistry, sources, functions, metabolism, and deficiency symptoms** of: ○ **Vitamin A** – vision, epithelial health, antioxidant role ○ **Vitamin D** – calcium metabolism, bone health ○ **Vitamin E** – antioxidant, membrane protection ○ **Vitamin K** – role in blood clotting (γ-carboxylation of clotting factors) **Understand the consequences of excess (hypervitaminosis)** of fat-soluble vitamins.	
18W	**Chemistry of Vitamins and Coenzymes trace elements**	Water-Soluble Vitamins **Describe the chemistry, sources, functions, coenzyme forms, and deficiency states** of: ○ **Vitamin B1 (Thiamine)** – carbohydrate metabolism; deficiency: Beriberi, Wernicke's encephalopathy ○ **Vitamin B2 (Riboflavin)** – FAD/FMN coenzymes ○ **Vitamin B3 (Niacin)** – NAD/NADP coenzymes; deficiency: Pellagra ○ **Vitamin B5 (Pantothenic acid)** – CoA formation ○ **Vitamin B6 (Pyridoxine)** – amino acid metabolism ○ **Vitamin B7 (Biotin)** – carboxylation reactions ○ **Vitamin B9 (Folate)** – DNA synthesis; deficiency: megaloblastic anemia	LEC 35&36

		○ **Vitamin B12 (Cobalamin)** – DNA & nerve function; deficiency: pernicious anemia ○ **Vitamin C (Ascorbic acid)** – collagen synthesis, antioxidant; deficiency: Scurvy **Understand vitamin absorption, transport, and storage** (especially B12 requiring intrinsic factor). **Relate vitamin deficiencies to clinical conditions** and recognize signs for diagnosis.	
		⚙ Trace Elements (Micronutrients) – Learning Objectives 🔹 General Concepts **Define trace elements** and distinguish them from macro minerals. **Explain the general roles of trace elements**: ○ Cofactors for enzymes ○ Structural roles ○ Antioxidant defence	
		🔹 Specific Trace Elements **Describe the biological roles, sources, daily requirements, metabolism, deficiency, and toxicity** of: • **Iron (Fe)** – haemoglobin synthesis; deficiency: anaemia • **Zinc (Zn)** – enzyme function, wound healing; deficiency: growth retardation, dermatitis • **Copper (Cu)** – iron metabolism, enzyme function; disorders: Wilson's, Menkes • **Iodine (I)** – thyroid hormone synthesis; deficiency: goiter, cretinism • **Selenium (Se)** – antioxidant defense (glutathione peroxidase); deficiency: cardiomyopathy • **Manganese (Mn)** – cofactor in metabolism • **Chromium (Cr)** – insulin function • **Fluoride (F)** – dental enamel health; excess: fluorosis	

		Understand iron metabolism and regulation: • Role of transferrin, ferritin, hepcidin • Iron absorption and transport **Recognize trace element toxicities and their clinical manifestations.**	
19W	**Chemistry of Nucleotides & metabolism (I)**	Nucleotide Chemistry – Learning Objectives **Define nucleotides and nucleosides**: ○ Structure and difference between them ○ Components: nitrogenous base, sugar, phosphate **Classify nitrogenous bases**: ○ **Purines**: adenine, guanine ○ **Pyrimidines**: cytosine, thymine, uracil **Describe the structure and functions of nucleotides**: ○ Role in DNA/RNA synthesis ○ Energy carriers (ATP, GTP) ○ Second messengers (cAMP, cGMP) ○ Coenzymes (NAD^+, FAD, CoA) **Understand base pairing and tautomerism** in purines and pyrimidines. **Explain nucleic acid structure** (briefly, as part of context): ○ DNA vs RNA ○ 5' to 3' orientation	LEC 37&38
20W	**Chemistry of Nucleotides & metabolism (II)**	Nucleotide Metabolism – Learning Objectives Purine Metabolism **Outline the de novo synthesis pathway** of purine nucleotides: ○ Starting materials (ribose-5-phosphate, PRPP) ○ Key enzymes and regulatory steps	LEC 39&40

		Describe the salvage pathway of purines: ○ Role of HGPRT and APRT enzymes ○ Clinical relevance (Lesch-Nyhan syndrome) **Explain purine degradation:** ○ Formation of uric acid ○ Enzyme: xanthine oxidase **Relate purine metabolism to clinical conditions:** ○ Gout (uric acid accumulation) ○ Hyperuricemia ○ Immunodeficiency (e.g. ADA deficiency in SCID)	
		◆ Pyrimidine Metabolism **Describe the de novo synthesis of pyrimidines:** • Role of carbamoyl phosphate synthetase II (CPS II) • Formation of UMP, UTP, CTP **Understand the synthesis of thymidine nucleotides:** • Role of thymidylate synthase • Folate dependence **Describe pyrimidine degradation:** • Simpler than purine degradation • Produces β-alanine, β-aminoisobutyrate **Recognize clinical disorders of pyrimidine metabolism:** • Orotic aciduria (UMP synthase deficiency)	
21W	**Molecular biology**	Molecular Biology – Learning Objectives DNA Structure and Function **Describe the structure of DNA:** ○ Double helix, base pairing, antiparallel strands ○ Purines vs pyrimidines	LEC 41&42

		○ Hydrogen bonding and base stacking **Differentiate between DNA and RNA:** ○ Sugar type, nitrogenous bases, structure, and stability **Explain DNA packaging in eukaryotes:** ○ Role of histones and nucleosomes ○ Chromatin structure: euchromatin vs heterochromatin	
22W	Molecular biology	DNA Replication **Outline the process of DNA replication:** ○ Semiconservative mechanism ○ Origin of replication, replication fork, leading/lagging strands **Identify key enzymes in replication:** ○ DNA polymerase, helicase, primase, ligase, topoisomerase **Understand the concept of replication fidelity:** ○ Proofreading, mismatch repair	LEC 43&44
		Transcription (DNA → RNA) **Describe the process of transcription:** ○ RNA polymerase, promoter regions, transcription factors **Differentiate between prokaryotic and eukaryotic transcription** **Explain RNA processing in eukaryotes:** ○ Capping, polyadenylation, splicing (removal of introns)	
23W	Molecular biology	Translation (RNA → Protein) **Explain the genetic code:**	LEC 45&46

		• Codons, start and stop codons, redundancy **Describe the process of translation:** • Initiation, elongation, termination • Role of ribosomes, tRNA, and aminoacyl-tRNA synthetase **Understand post-translational modifications:** • Phosphorylation, glycosylation, cleavage, etc.		
24W				LEC 47&48

11. Course Assessment

Distribution of Marks:

1. **Coursework mark: 40%**, distributed as follows:
   - First semester: 10%
     - Theory: 5%
     - Practical: 5%
   - Mid-year examination: 20%
     - Theory: 18%
     - Practical: 2%
   - Second semester: 10%
     - Theory: 5%
     - Practical: 5%
2. **Final examination: 60%**
   - Theory: 40%
   - Practical: 20%

Assessment Methods:

1. Written examinations: monthly, mid-year, and final examinations.
2. Short quizzes.
3. Practical examination using OSPE:
   - Oral examination
   - Skills examination
   - Assessment of practical knowledge

12. Learning and Teaching Resources	
Textbook of BIOCHEMISTRY for Medical Students Quick Review of Biochemistry for Undergraduates Questions and Answers CLINICAL BIOCHEMISTRY & METABOLIC MEDICINE	**Required prescribed textbooks:** 1. *Textbook of Biochemistry for Medical Students* 2. *Quick Review of Biochemistry for Undergraduates: Questions and Answers* 3. *Clinical Biochemistry and Metabolic Medicine* **Main references:** Not specified. **Recommended supporting books and references, including scientific journals and reports:** Not specified. **Electronic references and websites:** Not specified.