

علم الكيمياء الحيوية – (1)
(BIO.1)

معلومات عامة

اسم المقرر الدراسي ورمزه	علم الكيمياء الحيوية – (1) (BIO.1)
منسق البرنامج	عميد الكلية
القسم/ الشعبة التي تقدم البرنامج	قسم علم الكيمياء الحيوية
الأقسام العلمية ذات العلاقة بالبرنامج	قسم علم التشريح. قسم علم الأنسجة. قسم علم وظائف الأعضاء. قسم علم الكيمياء الحيوية. قسم علم الأدوية. قسم علم الأحياء الدقيقة. قسم علم الطفيليات. قسم علم الأمراض. قسم علم أمراض النساء والتوليد. قسم علم طب وجراحة العيون. قسم طب الأسرة والمجتمع. قسم الطب الشرعي والسموم. قسم الأمراض الباطنية وفروعها. قسم علوم الجراحة وفروعها. قسم طب الأطفال. قسم الأشعة والتصوير الطبي.
الساعات التدريسية للمقرر	ساعة 222\185 وحدة
اللغة المستخدمة في العملية التعليمية	اللغة الإنجليزية
السنة الدراسية/ الفصل الدراسي	2020م-2021م
منسق المقرر	رئيس القسم
تاريخ وجهة اعتماد المقرر	1997م\ وزارة التعليم العالي.

عدد الساعات الأسبوعية

المحاضرات	المناقشة	العملي	المجموع
08	02	02	12

أهداف المقرر

1. تزويد الطالب بالمفاهيم والمصطلحات الأساسية لعلم الكيمياء الحيوية.
2. اكساب الطالب المعرفة الأساسية للجزيئات الأساسية لتركيب الجسم.

3. تزويد الطالب بالمفاهيم والمصطلحات الأساسية لعلم كيمياء المناعة.
4. تزويد الطالب بدور الفيتامينات في عمليات التمثيل الغذائي.

مخرجات التعلم المستهدفة

المعرفة والفهم

1-أ	أن يعدد الطالب المصطلحات الأساسية لعلم الكيمياء الحيوية.
2-أ	أن يتعرف الطالب على التركيب والخصائص الفيزيائية والكيميائية للجزيئات الرئيسية المكونة للجسم.
3-أ	أن يعدد الطالب الأجسام المناعية للجسم من الناحية الكيميائية ودورها الفعال.
4-أ	أن يعدد الطالب وظائف الفيتامينات والمعادن في الجسم والامراض الناتجة عن زيادتها ونقصانها.

المهارات الذهنية

1-ب	أن يميز الطالب مدى أهمية علم الكيمياء الحيوية ومدى تداخله مع العلوم الأساسية الأخرى.
2-ب	أن يقارن الطالب العمليات الأيضية لجميع الفئات الرئيسية للجزيئات الحيوية للجسم.
3-ب	أن يستنتج الطالب الدور الدفاعي للأجسام المضادة بالجسم.
4-ب	أن يميز الطالب وظيفة وأعراض نقص الفيتامينات ودورها في النشاط الإنزيمي والامراض الناتجة عن سميتهما.

ج-المهارات العملية والمهنية

1-ج	أن يستخدم الطالب المصطلحات الأساسية لعلم الكيمياء الحيوية.
2-ج	أن يجري الطالب التجارب العملية لمعرفة الوحدات الأساسية للجسم.
3-ج	أن يخزن الطالب أنواع الأجسام المضادة المختلفة،
4-ج	أن يشخص الطالب نقص الفيتامينات وسميتها سريريا.

د-المهارات العامة والمنقولة

1-د	أن يكون الطالب قادر على الاتصال والتواصل التحريري والشفوي.
2-د	أن يكون الطالب قادرا على التحليل والاستنتاج
3-د	أن يكون الطالب قادرا على حل المشاكل.
4-د	أن يعزز الطالب الثقة بالنفس.

محتوى المقرر

النسبة المئوية	عدد الساعات				المحاضرة	الشفرة
	اجمالي	عملي	مناقشة	محاضرة		
18.02%	40	24	03	13	كيمياء الكربوهيدرات	BIO.I.A
11.26%	25	09	03	13	كيمياء الدهون	BIO.I.B
16.67%	37	21	03	13	كيمياء الأحماض الأمينية	BIO.I.C
3.6%	08	-	02	06	التوازن الحمضي الأساسي	BIO.I.D
4.5%	10	-	02	08	سوائل الجسم	BIO.I.E
2.7%	06	-	01	05	غشاء الخلية	BIO.I.F
5.86%	13	-	02	11	كيمياء الأحماض النووية	BIO.I.G
3.15%	07	-	01	06	كيمياء مناعية	BIO.I.H
7.21%	16	-	03	13	استقلاب المعادن	BIO.I.I
5.86%	13	-	02	11	إنزيم	BIO.I.J
7.21%	16	-	03	13	هياكل وتنظيم البروتينات	BIO.I.K
6.76%	15	-	03	12	بروتينات البلازما	BIO.I.L
7.21%	16	-	03	13	علم الفيتامينات	BIO.I.M
100%	222	54	31	137	إجمالي ساعات التدريس / التعلم في علم الكيمياء الحيوية – (I) (BIO. I)	
	100%	24.32%	14%	61.71%		

محتوى المقرر

Syllabus / Course Study in Biochemistry-I for First Academic Year of M. B. B. Ch.

CODE	TOPICS / COURSE STUDY
BIO.I	BIOCHEMISTRY -I
BIO.I.A	CHEMISTRY OF CARBOHYDRATE
BIO.I.A.1	Introduction to biochemistry, introduction to carbohydrates, definition of carbohydrates, functions of carbohydrates, glycobiology and sugar code of life, classification of carbohydrates, aldose -ketose isomerism, structural representation of sugars.
BIO.I.A.2	Classification of monosaccharides, pentoses of physiological importance, hexoses of physiological importance, oligosaccharides, classification of oligosaccharides.
BIO.I.A.3	Stereoisomerism, D and L isomers of glucose, optical activity, epimerism, enantiomers, diastereoisomers, physical properties, glycosides, pyranose and furanose ring structure, Haworth projection formula, Fischer projection formulas, anomerism, expression, mutarotation, chemical properties of carbohydrates.
BIO.I.A.4	Chemical properties, Enolization / tautomerization (action of alkalies), reducing properties, Benedict's test, Fehling's test, reduction (sugar alcohol formation), medical importance of sugar alcohol, osazone formation, medical importance of calcium gluconate, importance of glucuronic acid, oxidation by glucose oxidase, furfural formation, reduction to form alcohols.
BIO.I.A.5	Glycosides, important glycosides, medicinal application of glycosides, formation of esters, derivatives of monosaccharides, amino sugars, amino sugar acids, deoxy sugars, sugar acids.
BIO.I.A.6	Amylose, amylopectin, hydrolysis of starch, action of amylases on starch, glycogen / glucans, cellulose, cellulose digestion, importance of cellulose, the functions of dietary fibers.
BIO.I.A.7	Hemicellulose, inulin, dextrin, dextran, mucopolysaccharides / heteropolysaccharides / (heteroglycans), sialic acids, pectin, medicinal uses of pectin, chitin, agar and Agarose, hyaluronic acid, functions of hyaluronic acid, chondroitin 4-sulfate, dermatan sulfate, heparin, heparan sulfate, keratan sulfate, neutral.
BIO.I.A.8	Mucopolysaccharides, blood group substances (blood group Antigens), proteoglycans (mucoproteins), proteoglycan monomer, proteoglycan aggregates, functions of proteoglycans, mucins, clinical significance of mucins, transferrin, fibrinogen, follicle-

	stimulating hormone (FSH), erythropoietin (EPO), syndecans, glypicans, aggrecans, lumican, perlecan, elastin, collagen, fibronectin structure, integrins.
BIO.I.B	CHEMISTRY OF LIPIDS
BIO.I.B.1	Introduction to Lipids, definition of lipids, function of lipid, clinical significance of Lipid, classification of lipids, fatty acids, classification of fatty acids, unsaturated fatty acids, nomenclature of fatty acids, cis and trans isomers in unsaturated fatty acids
BIO.I.B.2	Significance of unsaturated fatty acids, trans fatty acids, substituted fatty acids, branched chain fatty acids, cyclic fatty acids, classification of fatty acids based on length hydrophobic chain. Biological importance of fatty acids, essential fatty acids, significance of essential fatty acids, eicosanoids, glycerol structure and significance, glycerol structure. Cholesterol – structure, forms of cholesterol, significance of cholesterol, normal serum level & variations, physiological variations, pathological variations, sterols of biological importance.
BIO.I.B.3	Simple lipids, properties of triacylglycerol, lipases, saponification, rancidity, ketonic rancidity, hazards of rancid Fats, waxes, identification of fats and oils.
BIO.I.B.4	Compound lipids, phospholipids, classification of phospholipids, glycerophospholipids, glycerophospholipids – structure, function of phospholipids, lecithin/sphingomyelin ratio.
BIO.I.B.5	Glycolipid (glycosphingolipids), function of glycosphingolipids, lipid storage diseases (Sphingolipidosis), amphipathic lipids, lipoproteins, structural lipoproteins, ketone bodies.
BIO.I.C	CHEMISTRY OF AMINO ACIDS
BIO.I.C.1	Introduction to amino acids, general structure of amino acids, classification of amino acids, classification based on structure, classification based on side chain characters, classification according to nutritional requirement.
BIO.I.C.2	Classification according to metabolic fate. Amino acids abbreviations, special groups in amino acids, properties of amino acids, isoelectric point, titration of amino acids, titration of Glycine, optical activity of amino acids
BIO.I.C.3	Reactions of amino acids, reactions due to amino group, formation of carbamino compound.
BIO.I.C.4	Reactions due to carboxyl group, formation of amide linkage, reactions due to side chains, ester formation, reactions due to SH group (Formation of disulphide bonds).
BIO.I.C.5	Transmethylation, reactions of amino & carboxyl groups, special functions of amino acids.

BIO.I.D	ACID BASE BALANCE
BIO.I.D.1	Acid base balance, water balance, functions of water, distribution of water, water turnover and balance, exogenous water, endogenous water, water output, electrolyte balance, electrolyte composition of body fluids.
BIO.I.D.2	Extracellular fluids (ECF), intracellular fluid (ICF), osmolarity, osmolality, relation of electrolyte balance, role of hormones in electrolyte and water balance.
BIO.I.D.3	Dehydration, dietary intake and electrolyte balance, overhydration, amphoteric substances, maintenance of blood pH. Blood buffers, blood contains three buffer systems, bicarbonate buffer system, blood pH and ratio of HCO_3^- to H_2CO_3 , phosphate buffer system, protein buffer system, respiratory mechanism for pH regulation.
BIO.I.D.4	Haemoglobin as a buffer, generation of HCO_3^- by RBC, renal mechanism for regulation of pH, renal regulation of pH, excretion of H^+ ions, reabsorption of bicarbonate,
BIO.I.D.5	Excretion of titratable acid, excretion of ammonium ions, disorders of acid-base balance, causes of acid-base disorders, metabolic acidosis, respiratory acidosis, metabolic alkalosis, respiratory alkalosis.
BIO.I.D.6	Anion gap, acid-base disorders & potassium, potassium and diabetic ketoacidosis, potassium, & alkalosis.
BIO.I.E	BODY FLUIDS
BIO.I.E.1	Cerebrospinal fluid (CSF), functions of CSF, CSF evaluation, composition of CSF, typical Viral Meningitis, typical bacterial meningitis, cerebrospinal fluid (CSF), low CSF protein, CSF protein estimation, serum and CSF albumin and IgG ratio, CSF proteins and central nervous system diseases, electrophoresis of CSF
BIO.I.E.2	Tumor marker, pleural fluid, transudate, exudate, biochemical constituents of pleural fluid.
BIO.I.E.3	pericardial fluid, synovial fluid, mucin clot test, reference intervals for synovial fluid constituents.
BIO.I.E.4	Amniotic fluid, seminal fluid, human milk, nutrients in human milk, storage of breast milk.
BIO.I.F	CELL MEMBRANE
BIO.I.F.1	Fluids mosaic model of plasma membrane, membrane lipids, phospholipid, function of membrane lipids, sphingolipids, cholesterol, glycolipids, membrane proteins.

BIO.I.F.2	Functions of membrane proteins, membrane carbohydrates, membrane fluidity, functions of plasma membrane, artificial membranes model, liposomes,
BIO.I.F.3	Transport across cell membrane, types transport mechanisms, transport of large molecules, types of transport mechanisms, passive or simple diffusion, uniport.
BIO.I.F.4	Co-transport system, antiport, active transport, sodium pump, functions of sodium potassium pump, secondary active transport, transport of macromolecule.
BIO.I.F.5	Exocytosis, endocytosis, phagocytosis – cell eating, pinocytosis – cell drinking, membrane channels and pumps, ion channels. Ionophores, osmosis, application of osmosis, water channels (Aquaporins).
BIO.I. G	NUCLEIC ACIDS CHEMISTRY
BIO.I.G.1	Nucleoproteins, nucleic acid, functions of nucleic acids, central dogma of life, composition of nucleoside, glycoside bond, composition of nucleotides, purines, minor purines present.
BIO.I.G.2	Nucleic acids, purine bases of plants, purine analogs, pyrimidines, pyrimidine analogs, sugars Present in DNA and RNA, principal Nucleotides, functions of nucleotides.
BIO.I.G.3	Physiological important nucleotides, ATP and ADP, nucleotides of guanine, GTP and GDP, nucleotide of uracil, nucleotide of cytosine, synthetic analogues of nucleotides, structure of DNA.
BIO.I.G.4	Chargaff's rule, DNA double helix, modification of bases in DNA, conformations of DNA double helix, DNA confirmation of A-, B- and Z-DNA, configurational difference between B-and Z-DNA, complementary strands, bent DNA, triple-stranded DNA, four-stranded DNA, size of the DNA molecule.
BIO.I.G.5	Denaturation of DNA, melting temperature (T_m), renaturation (reannealing), structure of RNA, types of RNA, messenger RNA (m-RNA), structural characteristics of m-RNA, heterogeneous nuclear RNA (hnRNA).
BIO.I.G.6	Transfer RNA (t- RNA), structural characteristics of t-RNA, small Nuclear RNAs (snRNAs), micro RNAs, miRNAs, & small Interfering RNAs, siRNAs, small Interfering RNAs (siRNAs), significance of mi RNAs & siRNAs, cellular RNA & their functions, RNA v/s DNA.
BIO.I.H	IMMUNO-CHEMISTRY
BIO.I.H.1	Immunology, antigen (Ag), epitope, antigenic determinant site, antibodies (Ab), immunoglobulins, structure of immunoglobulins, light chain, heavy chain, classes of immunoglobulin, Ig G, Rh iso immunization, Ig M, Ig A, Ig E, Ig D.
BIO.I.H.2	Production of Ig by multiple genes, antibody diversity, complement system, role of complement in disease.

BIO.I.H.3	Cascade activation of complements, four important functions, complement activation pathways, the Classical pathway, activation of C1, molecular structure of C1.
BIO.I.H.4	The Building of a C3 activation complex, C3 activation complex, this is done by cleaving C3 into C3a and C3b, C3b, C3b is an opsonin, building the C5 activation complex, the function of C5a.
BIO.I.H.5	Building the membrane attack complex, alternative pathway, lectin pathway, general functions of complement.
BIO.I.H.6	Paraproteinemias (Monoclonal Ig), multiple myeloma (plasmacytoma), malignancy of a single clone of plasma cells in bone marrow.
BIO.I. I	METABOLISM OF MINERALS
BIO.I.I.1.	Classification of minerals according to their essentiality, calcium metabolism, mechanism of absorption of calcium, factors causing increased absorption, factors causing decreased absorption.
BIO.I.I..2	Biochemical functions of calcium, myocardium, regulation of plasma calcium level, hypercalcemia, hypocalcemia, rickets, osteoporosis.
BIO.I.I. 3	Phosphorous metabolism biochemical functions of phosphorous, hypophosphataemia, hyperphosphataemia, copper metabolism, biochemical functions of copper, Wilson's disease, probable causes of Wilson's disease.
BIO.I.I. 4	Metabolism of sulfur, iodine, manganese, fluorine and selenium, iodine metabolism, most important functions of iodine, Goiter.
BIO.I.I. 5	Manganese metabolism, biochemical functions of manganese, Fluorine metabolism, biochemical functions of fluorine, deficiency and toxicity of fluorine, selenium metabolism, absorption and excretion of selenium, biochemical functions of selenium, deficiency of selenium, selenium toxicity.
BIO.I.I. 6	Molybdenum, metabolism of zinc, magnesium, sodium, potassium and chloride, biochemical functions of zinc, deficiency of zinc, acrodermatitis enteropathica, zinc toxicity.
BIO.I.I. 7	Magnesium metabolism, biochemical functions of magnesium, hypomagnesaemia, hypermagnesaemia,
BIO.I.I. 8	Sodium metabolism, biochemical reactions of sodium, hyponatremia, hypernatremia, potassium metabolism, biochemical functions of potassium, hypokalemia, hyperkalemia, chloride metabolism, hypochloremia, Hyperchloremia.
BIO.I. J	ENZYMOLGY

BIO.I.J.1	Definition of enzymes, classification of enzymes, cofactors, prosthetic group, role of metal ions, coenzymes, active site, enzyme substrate binding, Lock-and-Key, induced-fit model of enzyme-substrate binding.
BIO.I.J.2	Mechanism of action of enzymes, thermodynamic changes, activation energy, processes at the active site, enzyme specificity, bond specificity, group specificity, substrate specificity, optical specificity, geometrical specificity, co-factor specificity
BIO.I.J.3	Factors effecting enzyme activity, temperature, effect of pH on enzyme activity, effect of enzyme concentration, plot of substrate concentration versus reaction velocity, the Michaelis-Menten kinetics, Lineweaver-Burk plot, Km and its significance.
BIO.I.J.4	Enzyme inhibition, the effect of enzyme inhibition, applications of inhibitors, classification of enzyme inhibitors, types of enzyme inhibition, reversible inhibition, competitive enzyme inhibition, a competitive inhibitor, binding of S and I in different Situations.
BIO.I.J.5	Calculation of Ki Dixon plot, clinical significance of competitive enzyme inhibitors, non-competitive enzyme inhibition, Lineweaver Burk plot, the difference between competitive and non-competitive inhibition, examples of non-competitive enzyme inhibitors.
BIO.I.J.6	Uncompetitive enzyme inhibition, mixed type inhibition, irreversible inhibition, affinity labels, suicide inhibition.
BIO.I.J.7	Allosteric inhibition, allosteric inhibition – salient features, allosteric modification (positive), allosteric modification (negative), feedback (end point) inhibition, differences between types of inhibition, importance of enzyme inhibition.
BIO.I.J.8	Regulation of enzyme activity, mechanisms of enzyme regulation, regulation of enzyme concentration, regulation of enzyme concentration: Induction, regulation of enzyme concentration – repression, regulation of enzyme concentration – degradation, regulation of catalytic activity.
BIO.I.J.9	Significance of enzyme production as zymogen, enzyme / substrate compartmentation, allosteric enzymes, allosteric enzyme – kinetics.
BIO.I.J.10	Regulation of enzyme activity by covalent modifications, common reversible covalent modifications of enzyme, adenylation, ADP-ribosylation, methylation, phosphorylation, phosphorylation / signal transduction, feedback inhibition v/s feedback regulation, enzymatic activity regulation by isoenzyme (isozyme).
BIO.I. K	STRUCTURES AND ORGANIZATION OF PROTEINS

BIO.I.K.1	Structural organization of proteins, covalent bonds, non-covalent bonds, primary structure, peptide bond formation, characteristics of peptide bond, importance of primary structure.
BIO.I.K.2	Structure of Human insulin, determination of primary structure of protein, steps for determining the primary structure, DNA sequencing is used to determine the amino acid sequence.
BIO.I.K.3	Degradation of protein or polypeptide into smaller fragments, breakdown of polypeptides into fragments, determination of the amino acid sequence, Sequenator, reverse sequencing technique, secondary structure, alpha helix, β -pleated sheet (β -sheets), super secondary structures.
BIO.I.K.4	Triple helix, tertiary structure, domains, chaperones /HSP, quaternary structure, hemoglobin, study of higher levels of protein structure, structure-function relationship, transport proteins, structural proteins, collagen.
BIO.I.K.5	Enzymes, biologically important peptides, glutathione (GSH), function of glutathione, thyrotropin releasing hormone (TRH) – 3 amino acids, nanopeptide, vasopressin / antidiuretic hormone.
BIO.I.K.6	Pentapeptide, carnosine, aspartame, denaturation, protein aggregation inside cells , agents of denaturation (Heat, Violet shaking, Hydrostatic pressure (5,000 – 10,000 atm), UV Radiation, Chemical agents, Acids and alkalies, Salts of heavy metals (Pb, Hg), Reducing agents disrupt disulfide bonds, Chaotropic agents, Detergents, Disulphide bond reducers, Cross linking reagents.
BIO.I.K.7	Characteristics of denaturation, how denaturation occurs at levels of protein structure, loss of function, protein folding, factors that guide in proper protein folding, heat shock proteins, role of molecular chaperones, chaperonins, misfold.
BIO.I. L	PLASA PROTEINS
BIO.I. L.1	Components of plasma, separation of plasma proteins, albumin, structure of albumin, functions of albumin, clinical significance of albumin, protein bound calcium, drug interactions.
BIO.I. L2	Globulins, synthesis of globulins, α - globulins, α 1-antitrypsin, polymorphic forms of α 1-antitrypsin, clinical consequences of α 1-antitrypsin deficiency, orosomuroid / α 1-acid glycoprotein.
BIO.I. L.3	α 1-fetoprotein (AFP), α 2-globulins, Haptoglobin (Hb), clinical significance of haptoglobin (Hb), ceruloplasmin, clinical significance of ceruloplasmin, α 2-macroglobulin, β globulins.

BIO.I.L.4	Transferrin (Tf), Transferrin receptors, clinical significance of transferrin, C-reactive protein (β Globulin), Haemopexin (β globulin), complement C1q (β globulin), gamma globulins, different classes of immunoglobulins, major functions of immunoglobulins.
BIO.I.L.5	Fibrinogen, transport proteins, acute phase proteins, negative acute phase proteins, abnormal proteins, functions of plasma proteins, clinical significance of plasma proteins hypergammaglobulinemia, hypoproteinemia, Hypogammaglobulinemia.
BIO.I.M	VITAMINOLOGY
BIO.I.M.1	Definition of vitamins, classification of vitamins, vitamin A, vitamin A sources, digestion and absorption, transportation and storage of vitamin A, functions of vitamin A, role of vitamin A in vision, Wald's visual cycle, role in the regulation of gene expression and cell differentiation, vitamin A deficiency, clinical manifestation, derivatives of vitamin A used as drugs.
BIO.I.M.2	Vitamin K, dietary sources, absorption, transportation and storage, impaired absorption of vitamin K, recommended daily allowance (RDA), functions of vitamin K, calcium binding proteins, role of vitamin K in coagulation, vitamin K cycle, vitamin K antagonists, synthesis of bone calcium-binding proteins, vitamin K- dependent proteins, vitamin K deficiency causes, vitamin K deficiency in the newborn, clinical manifestations, laboratory studies, imaging studies.
BIO.I.M.3	Vitamin D, RDA, vitamin D is a sunshine, absorption of vitamin D, transport of vitamin D, storage, synthesis of 1,25 – dihydroxycholecalciferol, regulation of vitamin D synthesis, clinical importance, regulation of calcium and phosphorous plasma, biological functions, action on intestine, action on bone, action on kidney, doxercalciferol (Hectorol), paricalcitol (Zemplar), calcipotriol (Dovonex), calcipotriene Deficiency of vitamin D, rickets, biochemical findings, osteomalacia, renal rickets.
BIO.I.M.4	Vitamin E, absorption, mechanism of absorption, transport of vitamin E, storage, biomedical functions, deficiency, clinical features, muscular dystrophy, hepatic necrosis.
BIO.I.M.5	Water soluble vitamins, vitamin B1 (Thiamine), thiamine – Structure, thiamine synthesis, thiamine occurrence, activation of thiamine, recommended daily allowance of thiamine, metabolic role of thiamine, role of TPP in pyruvate dehydrogenase complex, role of TPP in α -Keto glutarate dehydrogenase complex, role of TPP in branched-chain α -keto acid dehydrogenase complex, role of TPP in transketolase reaction, role of TPP in tryptophan metabolism, role of TPP in nerve conduction,

	thiamine deficiency and impaired reactions, thiamine deficiency (Beri-Beri), causes of thiamine deficiency, increased consumption states, laboratory studies in thiamine deficiency, treatment of thiamine deficiency.
BIO.I.M.6	Vitamin (B2) – riboflavin, absorption, transport, storage, excretion, coenzymes of riboflavin, FMN and FAD, biochemical functions, flavoproteins, metalloflavoproteins, reactions requiring FMN, reactions requiring FAD, role in lipid metabolism, role in protein metabolism, dietary sources, deficiency, clinical features, riboflavin deficiency.
BIO.I.M.7	Vitamin B12 (Cyanocobalamin), structure, dietary sources, requirements of vitamin B12, absorption and the role of Intrinsic factor, intrinsic factor deficiency, transportation of cobalamin, storage of cobalamin, metabolic role of cobalamin, fate of propionyl CoA, fate of propionyl CoA in B12 deficiency, reaction catalyzed by thymidylate synthase, implications of inadequate thymidylate synthesis, folate trap, roles of cobalamin and folic acid in methionine metabolism, megaloblastic anemia clinical findings, neurological changes in B12 deficiency, laboratory findings, estimation of serum methylmalonic acid levels, essentials of diagnosis, differential diagnosis, pernicious anemia, clinical manifestations in pernicious anemia, gastrointestinal findings, nervous system, genitourinary system, complications, prognosis, treatment of vitamin B12 deficiency.
BIO.I.M.8	Vitamin B9 (Folic acid), active form, absorption, storage, biochemical functions, one carbon metabolism, generation of one carbon unit, role of methionine and vitamin B12, dietary sources, deficiency, clinical features, laboratory finding, FIGLU Test, folic acid deficiency and neural tube defects, folic acid deficiency & homocysteinemia, folic acid antagonists, significance.
BIO.I.M.9	Vitamin B6 (pyridoxine), absorption, transport, storage, excretion, biochemical function, transamination, decarboxylation, deamination, dietary sources, deficiency, clinical features.
BIO.I.M.10	Vitamin B7 (Biotin), coenzyme form, biochemical functions, dietary sources, deficiency, clinical features, biotin antagonists.
BIO.I.M.11	Vitamin C (Ascorbic acid), biosynthesis of ascorbic acid, absorption, storage, excretion, biochemical function, collagen formation, risk factors of vitamin C deficiency, pathophysiology, clinical manifestation, diagnosis, laboratory investigations.

BIO.I.M.12	Vitamin B3 (Niacin), biosynthesis of niacin from tryptophan, excretion, absorption, transport, storage, co-enzyme forms of niacin, NAD dependent enzymes, therapeutic uses of niacin. Vitamin B5 (Pantothenic acid), absorption, coenzyme A and Form, biochemical functions, deficiency. Vitamin like compounds, choline, lipoic acid, inositol, phytic acid, para amino benzoic acid.
------------	--

طرق التعليم والتعلم

- ✓ محاضرات تعليمية
- ✓ دروس عملية (تدريب معمل).
- ✓ حلقات مناقشة.
- ✓ التعلم الذاتي.

طرق التقييم

توزيع الدرجات						المادة
إجمالي % من العلامات	النهائي			النصفي		
	شفوي	عملي	نظري	عملي	نظري	
150 (100%)	15 (10%)	15 (10%)	90 (60%)	05 (3.3%)	25 (16.67%)	علم الكيمياء الحيوية – (BIO. I)

جدول التقييم

رقم التقييم	أسلوب التقييم	التاريخ
التقييم الأول	امتحان نصفي نظري	
التقييم الثاني	امتحان نصفي عملي	

	امتحان نهائي نظري	التقييم الثالث
	امتحان نهائي عملي	التقييم الرابع
	امتحان نهائي شفوي	التقييم الخامس

المراجع والدوريات

مكان تواجدها	المؤلف	النسخة	الناشر	عنوان المراجع	ر
Course Book					
مكتبة الكلية	Harper's Biochemistry	28th edition		Robert K. Murry	1
مكتبة الكلية	Biochemistry: a case- oriented approach	6th edition		Montgomery R et al.	2
Reference Books					
مكتبة الكلية	Lippincott's Reviews of Biochemistry.	3rd edition		Champe PC, Harvey RA, Ferrier DR, Lippincott William &Wilkins London,	1
مكتبة الكلية	Textbook of Biochemistry with Clinical Correlations.	2005.		Devlin TM Ed. Wiley - Lewis New York 2002.	2
مكتبة الكلية	Harper's Illustrated Biochemistry.	5th edition		Murray RK, Granner DK, Mayes PA, Rodwell VW, McGraw-Hill companies New York.	3
Web Sites:					
http://www.kumc.edu/biochemistry/resource.html					
http://www.medlib.iupui.edu/ref/biochem.htm					

الإمكانات المطلوبة لتنفيذ المقرر

ملاحظات	الإمكانات المطلوبة	ر. م
متوفر	قاعات دراسية	1
متوفر	جهاز كمبيوتر	2
متوفر	جهاز عرض مرئي	3
متوفر	انترنت	4
متوفر	معمل	5

التوقيع:

منسق المقرر: رئيس قسم الكيمياء الحيوية

التوقيع:

منسق البرنامج: عميد كلية الطب البشري

رئيس القسم:

التاريخ:

علم الكيمياء الحيوية – (II) (BIO.II)

معلومات عامة

اسم المقرر الدراسي ورمزه	علم الكيمياء الحيوية – (II) (BIO.II)
منسق البرنامج	عميد الكلية
القسم/ الشعبة التي تقدم البرنامج	قسم علم الكيمياء الحيوية
الأقسام العلمية ذات العلاقة بالبرنامج	قسم علم التشريح. قسم علم الأنسجة. قسم علم وظائف الأعضاء. قسم علم الكيمياء الحيوية. قسم علم الأدوية. قسم علم الأحياء الدقيقة. قسم علم الطفيليات. قسم علم الأمراض. قسم علم أمراض النساء والتوليد. قسم علم طب وجراحة العيون. قسم طب الأسرة والمجتمع. قسم الطب الشرعي والسموم. قسم الأمراض الباطنية وفروعها. قسم علوم الجراحة وفروعها. قسم طب الأطفال. قسم الأشعة والتصوير الطبي.

الساعات التدريسية للمقرر	206 ساعة \ 166 وحدة
اللغة المستخدمة في العملية التعليمية	اللغة الإنجليزية
السنة الدراسية/ الفصل الدراسي	2020-2021م
منسق المقرر	رئيس القسم
تاريخ وجهة اعتماد المقرر	1997م \ وزارة التعليم العالي.

عدد الساعات الأسبوعية

المحاضرات	العملي	المناقشة	المجموع
08	03	02	13

أهداف المقرر

1. اكساب الطالب المعرفة اللازمة للمسارات الخلوية والعمليات الأيضية للجزيئات المكونة للجسم.
2. تزويد الطالب بالمفاهيم والمصطلحات الأساسية لعلم الكيمياء الحيوية الجزيئية.
3. تزيد الطالب المعرفة الأساسية للغذاء السليم وقياسات الجسم السليم.
4. اكساب الطالب المعرفة اللازمة لنشاط الإنزيمات والهرمونات لمختلف العمليات الحيوية في الجسم.

مخرجات التعلم المستهدفة

المعرفة والفهم

1-أ	أن يتعرف الطالب على التركيب والخصائص الفيزيائية والكيميائية للجزيئات الرئيسية المكونة للجسم.
2-أ	أن يوضح الطالب المصطلحات الأساسية المستخدمة في الكيمياء الجزيئية.
3-أ	أن يتعرف الطالب على الغذاء السليم لمختلف الأعمار.
4-أ	ان يصف الطالب مدى أهمية ودور الانزيمات والهرمونات لمختلف العمليات الحيوية في الجسم.

المهارات الذهنية

ب-1	أن يقارن الطالب العمليات الأيضية لجميع الفئات الرئيسية للجزيئات الحيوية للجسم.
ب-2	أن يحلل الطالب مدى أهمية الكيمياء الجزيئية في علم الوراثة.
ب-3	أن يستنتج الطالب القياسات السليمة لجسم الإنسان لمختلف الأعمار.
ب-4	أن يحلل الطالب تنظيم وتأثير النشاط الانزيمي والهرموني ودورها الفعال في العمليات الحيوية للجسم.

ج-المهارات العملية والمهنية

ج-1	أن يجري الطالب بعض التجارب المعملية لتحليل الطي الحيوي.
ج-2	أن يخزن الطالب المصطلحات الأساسية المستخدمة في الكيمياء الجزيئية.
ج-3	أن يأخذ الطالب القياسات لجسم الإنسان.
ج-4	أن يشخص الطالب الأمراض الناتجة عن اضطرابات النشاط الانزيمي والهرموني في الجسم.

د-المهارات العامة والمنقولة

د-1	أن يكون الطالب قادر على الاتصال والتواصل التحريري والشفوي..
د-2	أن يكون الطالب قادرا على العمل الجماعي.
د-3	أن يعزز الطالب الثقة بالنفس.
د-4	أن يكون الطالب قادرا على التحليل والاستنتاج

محتوى المقرر

النسبة المئوية	عدد الساعات				المحاضرة	الشفرة
	اجمالي	عملي	مناقشة	محاضرة		
2.91%	06	-	02	04	مقدمة عن التمثيل الغذائي	BIO. II. A

14.1%	29	08	04	17	استقلاب الكربوهيدرات	BIO. II. B
3.4%	07	-	02	05	الطاقة الحيوية (الأكسدة البيولوجية)	BIO.II.C
14.1%	29	08	05	16	استقلاب الأحماض الأمينية	BIO. II. D
13.6%	28	08	04	16	التمثيل الغذائي لدهون	BIO. II. E
7.8%	16	04	02	10	استقلاب اليورفيرينات	BIO. II. F
4.9%	10	-	02	08	استقلاب xenobiotics	BIO. II. G
4.9%	10	-	02	08	استقلاب البيورين بيريميدين	BIO.II.H
13.6%	28	-	06	22	الكيمياء الحيوية الجزئية	BIO. II. I
3.9%	08	-	02	06	التغذية	BIO. II. J
3.9%	08	-	02	06	تكامل التمثيل الغذائي	BIO. II. K
6.3%	13	04	02	07	الأنزيمات السريرية	BIO. II. L
6.8%	14	-	03	11	الهرمونات (نقل الإشارة)	BIO.II.M
100%	206 (100%)	32 (15.5%)	38 (18.55%)	136 (66%)	إجمالي ساعات التدريس / التعلم في علم الكيمياء الحيوية – (II) (BIO. II)	

محتوى المقرر

Syllabus / Course Study in Biochemistry-II for Second Academic Year of M. B. B. Ch.

CODE	TOPICS / COURSE STUDY
------	-----------------------

BIO.II	BIOCHEMISTRY II
BIO. II. A	INTRODUCTION OF METABOLISM
BIO.II.A.1	Types of metabolic pathway, stages or phases of metabolism. Metabolic profile of organs, effect of exercise on metabolic profile. Metabolic adaptations during starvation.
BIO. II. B	METABOLISM OF CARBOHYDRATE
BIO.II.B.1	Details of digestion of carbohydrates, digestion in the Mouth, action of ptyalin (salivary amylase), digestion in the stomach, digestion in duodenum, action of pancreatic amylase, digestion in small Intestine, reactions catalysed by disaccharidases
BIO.II.B.2	Clinical significance of digestion, lactose intolerance, congenital lactose intolerance, baby with lactose Intolerance, adult with lactose intolerance, diagnosis of lactose intolerance, management of lactose intolerance, sucrase-Isomaltase deficiency. Absorption of carbohydrates, Na ⁺ dependent transporter, Na ⁺ independent transporters. factors affecting rate of absorption of monosaccharides. Uptake of glucose in peripheral cells.
BIO.II.B.3	Glycolysis, The first phase of glycolysis, significance of first priming reaction, hexokinase versus Glucokinase, glucokinase versus glucose-6-phosphatase, fate of glucose-6-P, the Second phase of glycolysis, Rappaport Luebering- shunt (R.L Shunt), significance of 2,3-bisphosphoglycerate.
BIO.II.B.4	The Metabolic fates of NADH and pyruvate —The products of glycolysis, product of glycolysis under anaerobic conditions, regulation of glycolysis, regulation at the level of hexokinase and glucokinase, regulation of phosphofructokinase, Inhibitors of glycolysis, significance of glycolysis other than energy production, clinical significance pyruvate kinase deficiency, biochemical basis for haemolytic anaemia.
BIO.II.B.5	HMP pathway, Glycolysis verses HMP pathway, pathway- Non-oxidative phase, degradation of excess pentoses through HMP pathway, significance of HMP Pathway, significance of Pentoses, utilization of Pentoses, significance of glycolytic intermediates, significance of CO ₂ , pathophysiology of haemolytic anaemia, treatment of haemolytic anaemia in G6PD deficiency.
BIO.II.B.6	Uronic acid pathway, importance of glucuronic acid pathway, effect of drug on uronic acid cycle, essential pentosuria.
BIO.II.B.7	Galactose metabolism, disorders of galactose metabolism, classical galactosemia, development of cataracts, galactokinase deficiency.

BIO.II.B.8	Fructose metabolism, biochemical importance of fructose. Sorbitol - poly pathway, sorbitol poly pathway in diabetes mellitus, defects in fructose metabolism, Essential fructosuria, hereditary fructose intolerance, amino sugars.
BIO.II.B.9	Sources of Pyruvate, fate of pyruvate, pyruvate to lactate conversion, pyruvate to oxaloacetate conversion, Pyruvate to alanine conversion, pyruvate to malate conversion, pyruvate to ethanol conversion, pyruvate to acetyl CoA conversion.
BIO.II.B.10	Components of pyruvate dehydrogenase complex, reaction catalysed by PDH complex, regulation of PDH complex, PDH Complex deficiency, treatment of PDH complex deficiency.
BIO.II.B.11	Gluconeogenesis- steps, regulation and significance, substrates of gluconeogenesis, reactions of gluconeogenesis, transportation of oxaloacetate, decarboxylation of oxaloacetate, reactions of gluconeogenesis, energetics of gluconeogenesis, substrates of gluconeogenesis, entry of lactate in to the pathway of gluconeogenesis.
BIO.II.B.12	Cori's cycle, entry of propionate into the pathway of gluconeogenesis, entry of glycerol into the pathway of gluconeogenesis, regulation of gluconeogenesis. reciprocal regulation of gluconeogenesis and glycolysis in the liver, Alcohol-related hypoglycaemia, hypoglycaemia in premature and low birth weight infants, hypoglycaemia in babies of diabetic mothers, maternal or foetal hypoglycaemia.
BIO.II.B.13	Roleplayed by kidney in gluconeogenesis. Glycogen metabolism, Glycogen storage site, reasons for storing glycogen as a fuel. Glycogenesis, liver and muscle glycogen, indirect contribution by muscle to maintain blood glucose level, steps of glycogenesis.
BIO.II.B.14	Glycogenolysis (degradation of glycogen), enzymes required for glycogen degradation, Steps of degradation. Release of glucose-1-P, advantages of phosphorylytic cleavage, remodeling of the glycogen substrate to permit further degradation, conversion of glucose -1- p to G-6-P., conversion of G-6-p to free Glucose
BIO.II.B.15	Energy expenditure for glycogenesis, energetic of glycogenesis and glycogenolysis, regulation of glycogen metabolism, regulation of glycogenolysis, reciprocal regulation of glycogen synthesis and degradation. glycogen storage diseases.
BIO.II.B.16	TCA cycle steps regulation and significance, citric acid cycle and requirement of oxygen, role of oxaloacetate in citric acid cycle, reactions of the citric Acid Cycle, energy yield per acetyl CoA per turn of cycle. regulation of the TCA cycle, significance of TCA Cycle.
BIO.II.C	BIOENERGETICS (BIOLOGICAL OXIDATION)
BIO.II.C.1	First law of thermodynamics, second law of thermodynamics, enthalpy (H), entropy (S), free energy (G), exergonic reactions, endergonic reactions, redox potential(E0)

BIO.II.C.2	Oxidation-reduction reactions, enzymes involved in biological oxidations, high energy compounds, classification of high energy compounds, ATP-ADP Cycle, ATP Synthesis, oxidative phosphorylation. substrate level phosphorylation.
BIO.II.C.3	Glycerol – phosphate shuttle, malate-aspartate shuttle, electron transport chain respiration, cellular metabolism, major activities promoted by ATP, oxidation and reduction of flavin coenzymes, complexes of electron transport chain, complex I (NADH-CoQ oxireductase), complex II Succinate – CoQ reductase, complex III CoQH ₂ -cytochrome c oxireductase, complex IV (Cytochrome oxidase), flavoproteins, cytochromes, electron carriers.
BIO.II.C.4	Q Cycle; the mechanism of H ⁺ transport in complex III, inhibitors of ETC, site specific inhibitors of ETC, H ⁺ /Proton transport, ATP synthase complex, proton motion and rotation of C ring, oxidative phosphorylation chemiosmosis.
BIO.II.C.5	ATP/ ADP exchange, creatine phosphate shuttle, uncouplers of oxidative phosphorylation, physiological uncouplers free energy release and ATP formation, P: O Ratio, regulation of ATP synthesis, substrate shuttles, Clinical aspect.
BIO. II. D	METABOLISM OF AMINO ACIDS
BIO.II.D.1	Digestion and absorption of proteins, endopeptidases and exopeptidases, digestion of proteins by gastric secretion, pancreatic digestion of proteins, release and activation of zymogens, action of proteolytic enzymes.
BIO.II.D.2	Intestinal digestion of proteins, mechanism of absorption of amino acids, Meister cycle (Gamma glutamyl cycle), absorption of intact proteins and polypeptides, Hartnup's disease.
BIO.II.D.3	Amino acid metabolism, amino acids pools, utilization of amino acids from amino acid pools, amino acid catabolism, protein turn over, amino acid degradation, fate of alpha amino group of amino acids.
BIO.II.D.4	Biosynthesis of urea, transamination, characteristics of transamination, role of B6
BIO.II.D.5	phosphate in transamination, biological significance of transamination, clinical significance of transaminases, AST-Serum glutamate-oxaloacetate aminotransferase (SGOT), ALT- Serum glutamate alanine transferase, diagnostic significance of amino transferases
BIO.II.D.6	Oxidative deamination of Glutamate, regulation of glutamate dehydrogenase, role of glutamate, role of glutamate and glutamate dehydrogenase, minor pathways of deamination, transport of ammonia to the liver, glutamate and glutamine relationship, glucose alanine cycle and role of glutamate

BIO.II.D.7	Ammonia intoxication, renal glutaminase activity, sources of ammonia, fate of ammonia.
BIO.II.D.8	Urea cycle, urea formation (Urea cycle), steps of urea formation, clinical significance, OTC deficiency and orotic aciduria, regulation of urea formation, synthesis and degradation of NAG, fate of urea, urea cycle disorders, clinical manifestations in urea cycle disorders, laboratory diagnosis of UCD, physiological conditions of high blood urea level.
BIO.II.D.9	Metabolism of glycine, phenyl alanine, conversion of phenylalanine to tyrosine, metabolism of tryptophan, metabolism of methionine, cysteine, metabolism of branched chain amino acids, metabolism of serine and threonine, metabolism of proline, metabolism of basic amino acids, Polyamines
BIO. II. E	METABOLISM OF LIPIDS
BIO.II.E.1	Digestion and absorption of lipids, functions of lipid in human body, dietary fat composition, digestion in mouth, Lingual lipase, triglyceride degradation, digestion in stomach, role of fats in gastric emptying, significance of lingual and gastric lipases, emulsification and digestion.
BIO.II.E.2	Digestion in small intestine, gastro intestinal hormones, contents of pancreatic juice, bile salts, synthesis of bile salts, enterohepatic circulation of bile salts, triacyl glycerol degradation by pancreatic lipase, significance of pancreatic lipase, cholesteryl ester degradation, phospholipid degradation, absorption of lipids, micelles.
BIO.II.E.3	Clinical significance of cholesterol absorption, resynthesis of triacyl glycerol and cholesteryl esters, lipid malabsorption (Steatorrhea), secretion of lipids from enterocytes.
BIO.II.E.4	Structure of chylomicron, transport and utilization of chylomicrons. clinical significance of chylomicron, synthesis and utilization.
BIO.II.E.5	Lipoproteins- Structure, classification, metabolism and significance, general structure of lipo-proteins, classification of lipoproteins, functions of Apo proteins, metabolism of chylomicrons, synthesis of chylomicrons, clinical significance, catabolism of chylomicrons, metabolism of VLDL, catabolism of VLDL, metabolism of LDL, metabolism of HDL, synthesis of HDL, role of LCAT, reverse cholesterol transport, HDL-cycle, functions of HDL, role of HDL in receptor mediated Endocytosis.
BIO.II.E.6	Clinical significance of lipoprotein metabolism. Fatty acid synthesis, sources of fatty acid, De novo synthesis of fatty acid, location of fatty acids synthesis, sources of NADPH, acetyl CoA – source and fate, transportation of acetyl CoA, fate of oxalo acetate, Enzymes and cofactors involved in the process of

	fatty acid synthesis, Fatty acid synthase complex, Steps of fatty acid synthesis, Structure of phosphopantetheine, the function of prosthetic group of the ACP, the first round FA biosynthesis, the activation of the acetyl group.
BIO.II.E.7	The activation of malonyl group, series of reactions, the result of fatty acyl synthase activity, comparison of β -oxidation and fatty acid synthesis.
BIO.II.E.8	Regulation of fatty acid synthesis, regulation of acetyl – CoA carboxylase, nutritional state regulates lipogenesis, fatty acid synthesis during fed state, fatty acid synthesis during fasting, role of insulin in fatty acid synthesis, insulin antagonizes Glucagon in its actions, sources of leptin, mechanism of action of leptin, fatty acid elongation, the desaturation of fatty acids, essential fatty acids, the fate of fatty acid, fatty acid oxidation, function of fatty acids.
BIO.II.E.9	Synthesis of triglycerides, triglycerides v/s glycogen, provision of dietary fatty acids, provision of fatty acids from adipose tissue, transportation of free fatty acids,
BIO.II.E.10	Types of fatty acid oxidation, Beta Oxidation, activation of fatty acids. Transport of fatty acids into mitochondrial matrix, role of carnitine, steps of beta-oxidation, Beta oxidation energy yield, Beta Oxidation of odd chain fatty acids, Beta oxidation of unsaturated fatty acids, Beta oxidation of poly unsaturated fatty acids.
BIO.II.E.11	Minor pathways of fatty acid oxidation, α - Oxidation of fatty acids, biological significance of α - oxidation, clinical significance of α - oxidation, Omega oxidation of fatty acids, significance of omega oxidation, peroxisomal oxidation of very long chain fatty acids, comparison between peroxisomal and mitochondrial oxidation, Significance of peroxisomal oxidation.
BIO.II.E.12	Ketosis – causes and consequences, ketogenesis, formation of acetone, formation of β -hydroxy butyrate, utilization of ketone bodies, utilization of Beta-hydroxybutyrate, Regulation of ketosis, regulation of CAT-1 activity, biological significance of ketone bodies, ketonemia, clinical significance-ketoacidosis, starvation induced ketosis, diabetic Keto- acidosis, alcoholic ketoacidosis (AKA).
BIO.II.E.13	Cholesterol synthesis steps and regulation, structure of cholesterol, functions of cholesterol, sources of cholesterol, steps of synthesis of cholesterol, regulation of cholesterol biosynthesis, transport of cholesterol. Uptake of LDL cholesterol, hypercholesterolemia and the consequences, hypolipidemic drugs, role of diet in regulating cholesterol levels, atherosclerosis, pathogenesis of atherosclerosis, components of atherosclerotic plaque.

BIO.II.E.14	Phospholipids metabolism, classification of phospholipids, synthesis of phospholipids, synthesis of glycerophosphatides, mechanism of RDS, foetal lung maturity, synthesis of phosphatidylserine, formation of phosphatidylinositol, synthesis of phosphatidyl glycerol and cardiolipin, formation of plasmalogens, synthesis of sphingomyelins, degradation of phospholipids, role of LCAT in lecithin metabolism, degradation of sphingomyelins.
BIO.II.E.15	Metabolism of glycolipids, degradation of cerebrosides and sphingomyelins, ganglioside, synthesis of gangliosides, lysosomal storage diseases,
BIO.II.E.16	Eicosanoids, prostaglandin synthesis, cyclooxygenase, inhibition of prostaglandin synthesis, degradation of prostaglandins, biochemical function of prostaglandins, biochemical applications of prostaglandins.
BIO.II.F	METABOLISM OF PORPHYRINS
BIO.II.F.1	Heme chemistry, normal levels of hemoglobin, functions of hemoglobin, structure of globin, derivatives of hemoglobin, structure of heme, formation of heme pockets, other forms of hemoglobin, Hb-A1c (Glycosylated Hb), diagnostic importance of HbA1c, myoglobin.
BIO.II.F.2	Heme synthesis, regulation of heme synthesis, regulation in the liver, regulation in the erythroid cells, heme catabolism, fate of globin, sources of heme, heme oxygenase, transport of bilirubin to liver, albumin-bilirubin complex, conjugation of Bilirubin, excretion of Bilirubin into Bile, fate of bilirubin
BIO.II.F.3	Hemoglobinopathies, types of abnormal Hb, globin synthesis, sickle-cell anemia (HbS), molecular basis of HbS, homozygous and heterozygous HbS, mechanism of sickling in sickle-cell anemia, HbS gives protection against malaria, diagnosis of sickle cell anemia, management of sickle cell disease.
BIO.II.F.4	Hemoglobin C disease, hemoglobin D, hemoglobin E, thalassemias, molecular basis of thalassemias, α -Thalassemiases, salient features of different α -thalassemias, β -thalassemias, β -Thalassemia minor, β -Thalassemia major
BIO.II.F.5	Porphyrias, Classification of porphyrias, hyperbilirubinemia, Van den Bergh test for Bilirubin.
BIO.II.F.6	hyperbilirubinemia, Congenital hyperbilirubinemias, Crigler-Najjar Syndrome, Gilbert's disease, Dubin Johnson Syndrome, Rotor syndrome, Acquired hyperbilirubinemia, Hemolytic anemia, Hepatic (hepatocellular) jaundice, Obstructive jaundice, Neonatal jaundice, Breast milk jaundice
BIO. II. G	METABOLISM OF XENOBIOTICS

BIO.II.G.1	Definition of xenobiotics, classes of xenobiotics, metabolism of xenobiotics, Phase 1, enzymes involved in the dehalogenation reactions Phase 2, biotransformation/detoxification reactions, role of liver, overview of biotransformation reactions
BIO.II.G.2	Overview of detoxification reactions, comparing Phase I and Phase II, factors affecting biotransformation of drugs, cytochrome P450 enzyme system, properties of Human Cytochrome P450s.
BIO.II.G.3	Phase 2 –conjugation, types of phase 2 reactions, glucuronidation, sulfation, acetylation, methylation, conjugation with Amino acids, conjugation with Glutathione, effects of Xenobiotics.
BIO.II.H	PURINE PYRIMIDINE METABOLISM
BIO.II.H.1	Nucleoproteins, digestion and absorption of nucleoproteins and nucleic acids.
BIO.II.H.2	Formation of purine ring, steps in purine biosynthesis, synthesis of AMP and GMP from IMP, synthesis of AMP, synthesis of GMP, formation of di and tri-phosphates
BIO.II.H.3	Inhibitors of purine synthesis, salvage pathway for purines, regulation of purine
BIO.II.H.4	Biochemical mechanism of gout, treatment of gout, Lesch – Nyhan syndrome, Hypouricemia.
BIO.II.H.5	Synthesis of pyrimidine, regulation of pyrimidine synthesis
BIO. II. I	MOLECULAR BIOCHEMISTRY
BIO.II.I.1	Nucleic acids, components of a nucleotide, basic structure of pyrimidine and purine, nomenclature of nucleic acid components, nucleoside and base analogs can be used as anti-cancer and anti-virus drugs, DNA structure, the secondary structure of DNA is the double helix, base stacking, major stacking forces, structural forms of DNA, structure of nucleosome core, DNA melting and annealing, melting point (t_m) of DNA.
BIO.II.I.2	Functions of DNA and summary of structure, DNA replication, DNA – Double helical structure, directionality of DNA, leading and lagging strands, Okazaki fragments, energy of replication, RNA prime.
BIO.II.I.3	DNA replication-steps, components of replication, initiation of replication, origin of replication (Replicon), origin of replication – prokaryotes, origin of replication - eukaryotes, mechanism of initiation, unwinding of DNA, formation of the replication fork, replication Fork, formation of replication bubbles, replication bubbles.
BIO.II.I.4	The DNA polymerase complex, differences between DNA polymerase I, II and III, eukaryotic DNA polymerases, initiation and elongation of DNA synthesis, base pairing in DNA replication, DNA Topo isomerases, mechanism of action of topoisomerases, formation of super coils, primer removal and nick sealing, proof reading and editing, elongation

BIO.II.I.5	Termination of replication, reconstitution of chromatin structure, DNA synthesis and the cell cycle,
BIO.II.I.6	Telomeres, mechanism of action of telomerase, telomere structure and telomere-binding protein lower eukaryotes, telomeric protection through G-quadruplexes, Hayflick limit, inhibitors of DNA replication
BIO.II.I.7	DNA transcription, similarities between replication and transcription, differences between replication and transcription, template strand, transcription unit, transcription unit and primary transcript, primary transcript, bacterial DNA-dependent RNA polymerase, mammalian DNA-dependent RNA polymerases.
BIO.II.I.8	Prokaryotic transcription, overview of prokaryotic DNA transcription, structure of bacterial prokaryotic promoter region.
BIO.II.I.9	Eukaryotic transcription, prokaryotic versus eukaryotic transcription, modifications of prokaryotic primary transcript, modifications of primary transcript in prokaryotes, modifications of primary transcript of mRNA in prokaryotes
BIO.II.I.10	Post transcriptional modifications in eukaryotes, processes involved in the post transcriptional modifications, post transcriptional modifications of ribosomal RNA (r-RNA), post Transcriptional modifications of Transfer RNA (t-RNA), post transcriptional modifications of pre-m-RNA, removal of introns (Splicing), Splicing of m-RNA, splicing consensus sequences, clinical significance of splicing, alternative splicing, biological significance of splicing
BIO.II.I.11	Inhibitors of transcription, Regulation of gene expression in prokaryotes, significance of gene expression, control of gene expression, types of gene regulation, responses in gene expression,
BIO.II.I.12	Features of prokaryotic gene expression. Cistron, Lac operon model, inducible lac operon, components of lac operon, negative control- repression, state of lac operon in the presence of only glucose, maximum expression of lac operon, constitutive expression and continuous repression,
BIO.II.I.13	Regulation of gene expression in eukaryotes, purpose of regulation of gene expression, control of gene expression, differences between gene expression in prokaryotes and eukaryotes, mechanism of regulation of gene expression, formation and disruption of nucleosome structure, nucleotide synthesis, conversion of ribonucleotides to deoxy ribonucleotides, supply of reducing equivalents.
BIO.II.I.14	Regulation of deoxyribonucleotide synthesis, purine degradation, hyperuricemia and gout, types of gout, primary gout, secondary gout, clinical features, investigation, treatment of gout, pseudogout, Lesch – Nyhan syndrome, hypouricemia, ADP and PNP

	deficiency, food Lists that increase uric acid level in human body, synthesis of pyrimidines, regulation of pyrimidine synthesis.
BIO.II.J	NUTRITION
BIO.II.J.1	Definition of nutritional status, the nutritional status of an individual has consequences, purpose of nutritional assessment, methods of nutritional assessment, direct methods of nutritional assessment.
BIO.II.J.2	indirect methods of nutritional assessment, height measurement, measuring recumbent length in infants and standing height in children, weight measurement, nutritional indices in adults, interpretation of BMI for adults, waist circumference, hip circumference, interpretation of waist / hip ratio (WHR), body mass index for children and teens.
BIO.II.J.3	Body mass index for children and teens, advantages of anthropometry, limitations of anthropometry, clinical assessment, interpretation of dietary data, initial laboratory assessment, specific lab. Tests, biochemical methods, limitation of biochemical methods
BIO.II.K	INTEGRATION OF METABOLISM
BIO.II.K.1	Integration of metabolism, significance of integration of metabolism, major metabolic pathways and their control sites, key junctions, integration of metabolism at cellular level, inter-conversion between three principal components.
BIO.II.K.2	Conversion of carbohydrates into fats, conversion of fatty acids into carbohydrate, integration of metabolism at tissue or organ level, role of liver,
BIO.II.K.3	Role of adipose tissue, role of heart muscle, role of brain in integration of metabolism, overview of the absorptive (fed) state, enzyme changes in the fed state.
BIO.II.L	CLINICAL ENZYMOLOGY
BIO.II.L.1	Diagnostic significance of enzymes, enzymes as diagnostic markers, possible mechanisms responsible for increased serum level, decreased serum level, units of serum enzyme activity.
BIO.II.L.2	Clinical significance of enzyme, estimation enzymes as diagnostic markers in different diseases, diagnosis of AMI, serum enzymes in liver diseases, serum enzymes in bone diseases, serum enzymes in muscle disease.
BIO.II.L.3	Serum enzymes in GI tract disease, enzymes as tumor markers, enzymes as diagnostic reagents, enzymes as therapeutic agents.
BIO.II.M	HORMONES (SIGNAL TRANSDUCTION)

BIO.II.M.1	Direct contact signalling, hormones, signal transduction, the stages of chemical cell signalling, four classes of second messengers, receptors, extracellular receptors. G protein coupling receptors (GPCRs), receptors associated with GPCRs, cAMP-Dependent pathway.
BIO.II.M.2	Popeye domain containing proteins (Popdc), exchange proteins activated by cAMP (EPAC) such as RAPGEF3. Cyclic nucleotide-gated ion channels, cyclic AMP–regulated guanine nucleotide exchange factors
BIO.II.M.3	Molecules that inhibit the cAMP pathway. Phosphatidylinositol signal pathway, the effects of Ca ²⁺ are also remarkable. The Rho/Rho kinase system, Pertussis causes cough, mechanism of diarrhea by cholera.
BIO.II.M.4	Guanylate cyclase - cGMP as second messenger, mechanism of action of acetylcholine, natriuretic Peptide, downstream reactions of cGMP, therapeutic applications. Receptors with kinase activity, mechanism of action of Insulin, JAK-STAT signalling pathway
BIO.II.M.5	Clinical significance, drugs targeting the JAK-STAT pathway. Threonine – serine kinase receptors.
BIO.II.M.6	Non-receptor tyrosine kinases (nRTKs). Integrins, toll gate receptors, ligand gated ion channel, intracellular receptors.
BIO.II.M.7	Desensitization, types of desensitization, series of events in Opioid Receptor desensitization, mechanism of desensitization by arrestin, receptor upregulation, super sensitivity, Diseases Resulting from Receptor Malfunction

طرق التعليم والتعلم

- ✓ محاضرات تعليمية
- ✓ دروس عملية (تدريب معمل).
- ✓ حلقات مناقشة.
- ✓ التعلم الذاتي.

طرق التقييم

توزيع الدرجات						المادة
إجمالي % من العلامات	النهائي			النصفي		
	شفهي	عملي	نظري	عملي	نظري	

150 (100%)	15 (10%)	15 (10%)	90 (60%)	05 (3.3%)	25 (16.67%)	علم الكيمياء الحيوية - (I) (BIO. I)
---------------	-------------	-------------	-------------	--------------	----------------	---

جدول التقييم

رقم التقييم	أسلوب التقييم	التاريخ
التقييم الأول	امتحان نصفي نظري	
التقييم الثاني	امتحان نصفي عملي	
التقييم الثالث	امتحان نهائي نظري	
التقييم الرابع	امتحان نهائي عملي	
التقييم الخامس	امتحان نهائي شفوي	

المراجع الدورية

مكان تواجدها	المؤلف	النسخة	الناشر	عنوان المراجع	ر
Course Book					
مكتبة الكلية	Harper's Biochemistry	28th edition		Robert K. Murry	1
مكتبة الكلية	Biochemistry: a case-oriented approach	6th edition		Montgomery R et al.	2
Reference Books					
مكتبة الكلية	Lippincott's Reviews of Biochemistry.	3rd edition		Champe PC, Harvey RA, Ferrier DR, Lippincott William & Wilkins London,	1
مكتبة الكلية	Textbook of Biochemistry with Clinical Correlations.	2005.		Devlin TM Ed. Wiley - Lewis New York 2002.	2

مكتبة الكلية	Harper's Illustrated Biochemistry.	5th edition		Murray RK, Granner DK, Mayes PA, Rodwell VW, McGraw-Hill companies New York.	3
Web Sites: http://www.kumc.edu/biochemistry/resource.html http://www.medlib.iupui.edu/ref/biochem.htm					

الإمكانات المطلوبة لتنفيذ المقرر

ملاحظات	الإمكانات المطلوبة	ر. م
متوفر	قاعات دراسية	1
متوفر	جهاز كمبيوتر	2
متوفر	جهاز عرض مرئي	3
متوفر	انترنت	4
متوفر	معمل	5

التوقيع:

منسق المقرر: رئيس قسم الكيمياء الحيوية

التوقيع:

منسق البرنامج: عميد كلية الطب البشري

رئيس القسم:

التاريخ: