



COURSE SPECIFICATION

B.Second part MD Medical Biochemistry & Molecular Biology (Advanced Level)

(A)Administrative information

1.Programme offering the course.	M.D. of Medical Biochemistry
2.Department offering the programme.	Medical biochemistry department
3.Department responsible for teaching the course.	Medical biochemistry department
4.Part of the programme.	2nd part
5.Date of approval by the Department's council	1/11/2015
6.Date of last approval of programme specification by Faculty council	9/8/2016
7.Course title.	Medical Biochemistry & Molecular Biology (advanced course)
8.Course code.	BIC 604
9.Total credit hours.	Lectures= 23 hour. Practical= 10 hour & Other activities= 5hour
Total teaching hours	345 hours lectures 300 hours practical

Module 1: Protein structure and function & Biochemistry of intra-cellular & extra-cellular communication.

(B) Professional information

(1) Module Aims:

- To educate students about different protein structure with relation to its function & also to provide the students with updated data and researches concerned with metabolic and genetic diseases of different protein, as well as laboratory diagnosis of those diseases.
- To provide the candidate with recent and advanced knowledge about different biochemical intracellular communication mechanisms and cellular transduction pathways.

(2) Intended Learning Outcomes (ILOs):

A- Knowledge and Understanding

On successful completion of the course, the candidate will be able to:

AII-1	Discuss the biomedical importance & properties of amino acids & peptides
AII-2	<p>AII-2.1 Describe methods used in analyzing & determination of sequence of proteins and peptides.</p> <p>AII-2.2 Identify proteome & proteomics (definition & techniques)</p> <p>AII-2.3 Describe the four orders of protein structure with stress on the stabilizing factors & techniques used in determining the three dimensional structure of protein.</p> <p>AII-2.4 Explain Protein folding (Definition , processing , quality control system of protein folding or proteastasis , unfolded protein response in the cytosol & endoplasmic reticulum , pathologic consequences of misfolding)</p>
AII-3	<p><u>AII-3.1</u> Describe collagen as an example of fibrous proteins (types, structure, biosynthesis & nutritional and genetic disorders of collagen maturation).</p>

<p>AII-4</p>	<p>AII-4.<u>1</u>. describe myoglobin (structure ,function &oxygen dissociation curve)</p> <p>AII-4.<u>2</u>. describe haemoglobin (structure , types)</p> <p>AII-4.<u>3</u>. define haemoglobin function (oxygen dissociation curve, conformational changes & role of 2,3 biphosphoglycerate)</p> <p>AII-4.<u>4</u>. mention mutations affecting human haemoglobin and resulting diseases.</p>
<p>AII-5</p>	<p>AII-5.<u>1</u> identify characters and types of enzymes.</p> <p>AII-5.<u>2</u>. compare different mechanisms to facilitate enzyme catalysis.</p> <p>AII-5.<u>3</u> Identify role of prosthetic groups, cofactors and co-enzymes and their types.</p> <p>AII-5.<u>4</u> identify isoenzymes</p> <p>AII-5.<u>5</u> Explain how catalytic activity of enzymes facilitate their detection.</p> <p>AII-5.<u>6</u> Demonstrate application of enzymes in diagnosis of diseases.</p> <p>AII-5.<u>7</u> Describe types of chemical reactions and factors affecting the reaction rate.</p> <p><u>AII-5.7.a</u>. define free energy and activation energy.</p> <p>AII-5.<u>8</u>. Discuss kinetics of enzymatic catalysis with stress on factors affecting,Michaelis-Menten and Hill equation.</p> <p>AII-5.<u>8.a</u> Distinguish competitive and non competitive inhibition.</p> <p>AII-5.<u>9</u> define types of enzyme-catalyzed reactions</p> <p>AII-5.<u>10</u> recognize role of enzymes in drug discovery.</p> <p>AII-5.<u>11</u> Explain regulation of enzyme at both the quantity&catalytic activity levels.</p>
<p>AII-19</p>	<p>AII- 19.1 Describe Steroid synthesis</p> <p>AII- 19.2 Describe Catecholamines synthesis</p> <p>AII- 19.3 Describe Thyroid synthesis</p> <p>AII- 19.4 Describe Hormone synthesis from larger peptide precursors</p>

AII-20	<p>AII-20.1- Explain the target cell concept</p> <p>AII-20.2- Describe the sensory machinery that initiate signaling cascades including.</p> <ul style="list-style-type: none"> * Signals / ligands * Receptors : <ul style="list-style-type: none"> 1- Intracellular receptors (cytoplasmic & nuclear) 2- Membranous receptors <ul style="list-style-type: none"> * Ion / ligand gated channels * G protein coupled receptors * Enzyme linked receptors <p>AII-20.3- Analyze the propagation of signals to the cell interior (signal transduction pathway)</p> <ul style="list-style-type: none"> * c AMP signaling pathway * Phospho inositide / Ca⁺⁺ signaling pathway * c GMP signaling pathway * RAS / MAP Kinase signaling pathway * PI₃K / AKT /m Tot signaling pathway <p>AII-20.4- Describe cell survival signaling pathway</p> <p>AII-20.5- Analyze oncogenic signaling pathway</p>
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B- Intellectual skills

On successful completion of the course, the candidate will be able to.

B1	Interpret results of colorimetric and molecular tests.
B2	Interpret laboratory reports
B3	Formulate a systematic approach for laboratory diagnosis of metabolic and genetic diseases
B4	Analyze the electrophoresis bands by image analysis

B7	Make oral presentation and open discussions about scientific issues in a professional way.
B8	Estimate the risks of handling and use of chemical agents on community and environment as a part of their ethical heritage and consequently implement the standard guidelines of chemist and environmental safety.

C- Professional/practical skills

On successful completion of the course, the candidate will be able to:

C1	Measure different biological substances with chromatography (HPLC).
C3	Extract RNA from tissue by trizol and analyzing it using Reverse transcriptase- real time PCR technique..
C4	Extract protein from biological samples by trizol.
C5	Analyze gene expression in certain tissue through determination of the presence and measuring proteomics (Western blot technique).
C6	Use Gel documentation system to analyze digital image of the electrophoresis gel bands.

D- Communication & Transferable skills

D1	Demonstrate competence in data presentation, time management. Statistical analysis and interpretation.
D2	Demonstrate key skills in the retrieval, preparation, analysis and interpretation of information from different sources.
D3	Make effective use of information technology e.g. web and internet. Database work
D4	Demonstrate self-direction and some originality in tackling and solving problems
D5	Work effectively both individually and in team and making appropriate use of the capacities of group members
D6	Communicate effectively, using the appropriate method with audiences of different levels of knowledge or experience.

(3) module 1 content.

Subjects	No. of teaching hours
	Lectures
Updates of Amino acids & peptides	7
Updates of structure of protein & protein folding	7
Updates of Globular protein	7
Updates of Fibrous protein	6
Updates of Enzymes (action, kinetics, regulation)	13
Diversity of endocrine system	15
Hormone action & signal transduction	10
Total Teaching Hours	65

Log Book	
Subjects	No. of teaching hours
I) Practical	
Measure different types of proteins with chromatography (HPLC).	5
Analyze gene expression for different types of proteins through RNA extraction from tissue by trizol and Reverse transcriptase- real time PCR technique	15
Extract protein from biological samples by trizol.	5
Analyze gene expression in for different proteins in certain tissue through Western blot technique.	15
Analyze gene expression for different types of enzymes through RNA extraction from tissue by trizol and Reverse transcriptase- real time PCR technique	10

Measure different types of hormones with chromatography (HPLC).	5
Use Gel documentation system to analyze digital image of the electrophoresis gel bands.	10
II) other activities	35
Total log book activities	100

Module2. Bioenergetics and metabolism course

(A) Professional information

(1) **Module Aim.**

Provide the students with updated data and researches concerned with different body metabolism, metabolic integration and energy changes accompanying biochemical reaction.

(2) **Intended Learning Outcomes (ILOs):**

A- Knowledge and Understanding:

On successful completion of the course, the candidate will be able to.

AII-6	<p>AII-6-1 Discuss the redox potential.</p> <p>AII-6-2 Discuss oxidoreductases</p>
AII-7	<p>AII-7-1 Discuss Electron transport chain</p> <p style="padding-left: 20px;">AII-7-1-1 Differentiate between energy production in biological and non biological systems</p> <p style="padding-left: 20px;">AII-7-1-2 Identify Components of ETC</p> <p style="padding-left: 20px;">AII-7-1-3 Explain Sequence of events</p> <p>AII-7-2 Discuss Oxidative phosphorylation</p> <p style="padding-left: 20px;">AII-7-2-1 Discuss Definition, site and energy production</p> <p style="padding-left: 20px;">AII-7-2-2 Explain Theories of ATP synthesis</p>

- AII-7-2-3** Mention P/O ratio
- AII-7-2-4** Identify Inhibitors
- AII-7-2-5** Identify Uncouplers
- AII-7-2-6** Discuss Genetic mitochondrial disorders
- AII-7-2-7** **Explain** Oxidation of cytoplasmic NADH

All-7-3 Discuss and interpret bioenergetics
(definition, first law of thermodynamics, gibbs free energy and standard free energy)

All-7-4 Recognize ATP (sources and biological importance)

All-7-5 Describe Low and high energy bond

AII-8

All-8-1 describe Glycolysis
(definition, site, steps, biomedical and clinical importance, regulation, energetic and clinical aspects)

All-8-2 Recognize Pyruvate metabolism with stress on Oxidative decarboxylation
(definition, site, steps, regulation)

All-8-3 Discuss Citric acid cycle
(definition, site, steps, biomedical importance, regulation and inhibitors, energetic, clinical aspects and role of vitamins)

All-8-4 Discuss Glycogen metabolism including:

- All-8.4.1** Structure and function of glycogen
- AII-8.4.2** Glycogenesis (definition, site and steps)
- AII-8.4.3** Glycogenolysis (definition, site and steps)
- AII-8.4.4** Regulation of glycogen metabolism
- AII-8.4.5** Glycogen storage disease

All-8-5 Define and recognize Gluconeogenesis
(definition, site, substrates and steps, biomedical importance, regulation and clinical aspects)

All-8-6 Describe Hexosemonophosphate pathway
(definition, site, biomedical importance, function of NADP, regulation and clinical aspects)

All-8-7 Describe Uronic acid pathway
(definition, site, importance, pathways of UDPG, biosynthesis of amino sugars)

All-8-8 Discuss Metabolism of mono and disaccharides including:

AII-8-8-1 Fructose metabolism

(biomedical importance, conversion of fructose to glucose, conversion of glucose and mannose to fructose and inborn errors of fructose metabolism)

AII-8-8-2 Galactose metabolism

(biomedical importance, conversion of galactose to glucose, conversion of glucose to galactose and inborn errors of galactose metabolism)

All-8-9 Describe Insulin

(Structure, synthesis, mechanism of action, regulation of secretion, metabolic effects and catabolism)

All-8-10 Describe Glucagon

(Structure, mechanism of action, regulation of secretion and metabolic effects)

All-8-11 Interpret Blood glucose level

(regulation of blood glucose level and clinical aspects; glucosuria, hyper and hypoglycemia)

All-8-12 Interpret and differentiate between types of Diabetes mellitus

Definition, incidence, pathogenesis, metabolic changes and treatment of both types

Complications (acute and chronic and its pathogenesis)

All-8-13 Discuss Glycoproteins , glycosaminoglycans and proteoglycans

AII-8-13-1 Discuss Glycosaminoglycans

(structure, classification, synthesis, degradation and mucopolysaccharidosis)

AII-8-13-2 Discuss **Proteoglycans** (structure)

AII-8-13-3 Discuss **Glycoproteins**

(structure, synthesis, degradation and biomedical and clinical importance)

AII-9

All-9-1 Describe Lipogenesis

(definition, site, regulation, steps)

AII-9-1-1 Discuss Fatty acid synthesis

AII-9-1-1-a Describe Synthesis of saturated FA (Cytoplasmic FA synthesis, Mitochondrial FA synthesis, Microsomal FA synthesis)

AII-9-1-1-b Describe Synthesis of unsaturated FA

AII-9-1-2 Describe Synthesis of glycerol and TG

All-9-2 Describe and compare between different types of Fatty acid oxidation

AII-9-2-1 Explain B₂ oxidation , Alpha oxidation, Omega oxidation (definition, site, steps)

AII-9-2-2 Explain Oxidation of unsaturated FA

All-9-3 Recognize Active acetate (sources and fate)

All-9-4 Discuss Ketone bodies metabolism including:

AII-9-4-1 Ketogenesis (definition, site, steps, biomedical importance and regulation)

AII-9-4-2 Ketolysis (definition, site, steps, biomedical importance and regulation)

AII-9-4-3 Ketosis(definition, pathogenesis, causes and effects)

All-9-5 Describe Lipoprotein metabolism and differentiate between different types of lipoproteins including:

AII-9-5-1 Definition, site, steps, biomedical importance, regulation and metabolism of each type

AII-9-5-2 Apoproteins (definition, role and types)

AII-9-5-3 Enzymes in lipid transport

AII-9-5-4 Primary disorders of plasma lipoproteins.

All-9-6 Discuss Eicosanoids metabolism

(Definition, members, synthesis, biological actions, clinical aspects)

All-9-7 Describe Cholesterol metabolism

AII-9-7-1 Explain Structure, Synthesis, Transport and Degradation

AII-9-7-2 Mention Blood cholesterol levels and its clinical aspects

AII-9-7-3 Discuss Bile acids and bile salts (structure, synthesis and clinical aspects)

AII-9-7-4 Discuss Steroid hormones (synthesis, secretion and mechanism of action)

All-9-8 Recognize Phospholipid and glycosphingolipids metabolism including:

AII-9-8-1 Structure, Function, Biosynthesis and catabolism of different types of PL

AII-9-8-2 Types and synthesis of glycosphingolipidos

AII-9-8-3 Sphingolipidosis

	<p>All-9-9 Describe role of adipose tissue in lipid metabolism with stress on hormonal regulation</p> <p>All-9-10 Discuss Fatty liver (definition, causes ,pathogenesis and lipotropic factors)</p>
AII-10	<p>AII-10-1 describe amino acid pool</p> <p>AII-10-2 demonstrate catabolic pathways of amino acids (transamination-deamination-decarboxylation-transamidation)</p> <p>AII-10-3 Mention understanding sources & fates of ammonia</p> <p>AII-10-4 discuss urea biosynthesis (steps-regulation-metabolic disorders)</p> <p>AII-10-5 Explain the nitrogen balance</p> <p>AII-10-6 recognize biosynthesis of non essential amino acids</p> <p>AII-10-7 describe catabolism of carbon skeleton of a.a.</p> <p>AII-10-8 discuss conversion of amino acids to specialized product</p> <p style="padding-left: 40px;">AII-10-8a-describe (structure-synthesis-regulation-disorders) of porphyrin</p> <p style="padding-left: 40px;">AII-10-8b-list nitrogen containing compounds</p>
AII-11	<p>AII-11-1-discuss synthesis of purine nucleotide including:</p> <p style="padding-left: 40px;">a-denovo pathway (steps-regulation)</p> <p style="padding-left: 40px;">b-salvage pathway</p> <p style="padding-left: 40px;">c-deoxyribonucleotide synthesis(steps-regulation)</p> <p>AII-11-2 describe catabolism of purin nucleotides</p> <p>AII-11-3 explain metabolic disorders of purine metabolism (hypouricemia-hyperuricemia)</p> <p>AII-11-4 discuss pyrimidine synthesis & degradation including:</p> <p style="padding-left: 40px;">AII-11-4-a-denovo pathway (steps-regulation)</p> <p style="padding-left: 40px;">AII-11-4-b-salvage pathway</p> <p style="padding-left: 40px;">_AII-11-4-c-catabolism</p> <p>AII-11-5 Mention synthetic base analogues used in chemotherapy.</p>
AII-12	<p>AII-12-1 Describe enzyme change and metabolic fuels in fed & fasting state.</p> <p>AII-12-2 describe role of (liver-adipose tissue-muscle-brain) in fed & fasting state.</p> <p>AII-12-3 describe the metabolic changes in (DM ,pregnancy,lactation).</p> <p>AII-12-4 Explain metabolic pathways regulated at different levels of organization (at tissue & organ level).</p>

B-Intellectual skills.

On successful completion of the course, the candidate will be able to.

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B2	Interpret laboratory reports
B3	Formulate a systematic approach for laboratory diagnosis of metabolic disease.
B7	Make oral presentation and open discussions about scientific issues in a professional way.
B8	Estimate the risks of handling and use of chemical agents on community and environment as a part of their ethical heritage and consequently implement the standard guidelines of chemist and environmental safety.

C-Professional/practical skills.

On successful completion of the course, the candidate will be able to.

C1	Measure different biological substances with chromatography (HPLC).
C3	Extract RNA from tissue by trizol and analyzing it using Reverse transcriptase- real time PCR technique..
C4	Extract protein from biological samples by trizol.
C5	Analyze gene expression in certain tissue through determination of the presence and measuring proteomics (Western blot technique).
C6	Use Gel documentation system to analyze digital image of the electrophoresis gel bands.

D-Communication &Transferable skills

On successful completion of the course, the candidate will be able to.

D1	Demonstrate competence in data presentation, time management. Statistical analysis and interpretation.
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D2	Demonstrate key skills in the retrieval, preparation, analysis and interpretation of information from different sources.
D3	Make effective use of information technology e.g. web and internet. Database work
D4	Work effectively both individually and in team and making appropriate use of the capacities of group members
D5	Communicate effectively, using the appropriate method with audiences of different levels of knowledge or experience.

(3) Module 2 content.

Subjects	No. of teaching hours
	Lectures
1-Updates of Biological oxidation	7
2-Updates of Respiratory chain & oxidative phosphorylation	6
3-Updates of Carbohydrate metabolism & glycoprotein	25
4-Updates of Lipid metabolism	25
5-Updates of Protein & individual amino acid metabolism	25
6- Updates of Nucleic acid metabolism	17
7- Updates of Metabolic integration & Provision of metabolic fuel	15
Total teaching hours	120

Subjects	No. of Log book hours
	I) Practical
Measurements of different types of metabolites using HPLC.	35
Evaluate gene expression of metabolic regulatory proteins by RNA extraction analyzing it using Reverse transcriptase- real time PCR technique..	35

Protein extraction and measurement using Western blot technique.	30
Gel documentation system to analyze digital image of the electrophoresis gel bands.	10
Other activities	35
Total hours of Log book activities	145

Module3. Molecular biology & Informational macromolecules course

Professional information

(1) Module Aims:

Provide the students with recent data in molecular biology field , their application, in addition to enable the students to practice DNA extraction, gene analyze and other new technologies in the field and how to use those techniques in doing scientific researches.

(2) Intended Learning Outcomes (ILOs):

A- Knowledge and Understanding:

On successful completion of the course, the candidate will be able to.

AII-13	<p>AII-13.1 Discuss different levels of DNA structure (DNA primary & different types of DNA secondary structure).</p> <p>AII-13.2 Recognizing the definition & mechanisms of DNA denaturation & renaturation as methods of analyzing DNA structure.</p> <p>AII-13.3 Differentiation between DNA & RNA.</p> <p>AII-13.4 Enumerat different types of RNA with explaining the structure & function of each one</p>
AII-14	<p>AII-14.1 Discuss the chromatin structure with explanation of the histone proteins , nucleosomal structure & chromatin structure.</p> <p>AII-14.2 Describ the high order structure of the chromatin & its incorporation in the activity state of the chromatin.</p> <p>AII-14.3 Explain the DNA repetitive & non repetitive regions.</p> <p>AII-14.4 Compar different types of rearranging the genetic material including(chromosomal recombination, integration, cross over, gene conversion & transposition with explain examples on each in the living system).</p> <p>AII-14.6 Discuss DNA replication.</p>

	<p>AII-14.6a Defining the replication with recognizing the steps of replication.</p> <p>AII-14.6b Differentiating types of DNA polymerase in eukaryotes & Prokaryotes & the function of each one.</p> <p>AII-14.6c Recognizing the replication polarity.</p> <p>AII-14.6d identifying Timing of replication in the cell cycle & its application.</p> <p>AII-14.7 discuss DNA mutation & repair.</p> <p>AII-14.7a Recognizing the definition, causes & effect of DNA mutation.</p> <p>AII-14.7b mention different types of DNA repair.</p> <p>AII-14.7c Explain the clinical conditions associated with impaired repair.</p>
AII-15	<p>AII-15.1: <u>Discuss</u> RNA synthesis:-</p> <p>AII-15.1a Describe the classification of RNA and how it is synthesized from DNA template by RNA polymerase.</p> <p>AII-15.1b Compare between eukaryotic and prokaryotic DNA dependent RNA polymerase (also know the difference between euik and prok promoters).</p> <p>AII-15.1c Explain how RNA synthesis is cyclical process involve RNA chain initiation, elongation and termination.</p> <p>AII-15.1d Discuss different transcription factors and discusse the components, formation, assembly of basal transcription complex.</p> <p>AII-15.1e Recognize signals that regulate transcription termination and clarify how termination occurs either by Rho factor independent or Rho factor dependent manner.</p> <p>AII-15.2: Mention how RNA molecules usually processed before they become functional :</p> <p>AII-15.2a Discuss how introns removed and exons are spliced together and explain mechanism of mRNA splicing, alternative splicing and alternative promoters provides a form of regulation of mRNA.</p>

	<p>AII-15.2b Recognize how tRNA, rRNA are processed.</p> <p>AII-15.3 discuss how RNA is modified after it's synthesis.</p> <p>AII-15.3a Recognize copping, tailing, splicing and RNA editing of mRNA.</p> <p>AII-15.3b discuss post transcriptional modification of tRNA and rRNA.</p> <p>AII-15.3c Explain how RNA can acts as a catalyst.</p> <p>AII-15.3d discuss micro-RNA synthesis & their role in quality control of mRNA in P bodies.</p>
AII-16	<p>AII-16.1 :Explain different features of genetic code</p> <p>AII-16.2 :Explain the three phases of protein synthesis: initiation with formation of initiation complex, elongation and termination.</p> <p>AII-16.3 : Discuss the regulation and control of protein synthesis</p> <p>AII-16.3 a Explain control at the level of gene expression.</p> <p>AII-16.3b Explain the regulation and control of initiation</p> <p>AII-16.3c Explain how protein synthesis respond to environmental threats.</p> <p>AII-16.3d Explain how viruses can affect protein synth.</p> <p>AII-16.3e Recognize post translational processing affects the activity of synthesized protein.</p> <p>AII-16.3f Describe the effect of Antibiotics on bacterial protein synth.</p>

<p>AII-17</p>	<p>AII-17.<u>1</u> Classify types of genes according to the mechanism of their expression.</p> <p>AII-17.<u>2</u> recogniz different types of regulation of gene expression in prokaryotes</p> <p> AII-17.2a Recognize the catabolic regulation (lac operon)</p> <p> AII-17.2b Explain co-repression (tryptophan operon)</p> <p> AII-17.2c Explain genetic switching (λ phage cycle)</p> <p>AII-17.<u>3</u> classify the levels of euokaryotic regulation of gene expression.</p> <p> AII-17.3a Discuss of gene expression at the Genomic level (gene rearrangement & gene amplification)</p> <p> AII-17.3b Discuss of gene expression at the transcriptional level (DNA regulatory Protein & DNA regulatory regions) with explaining silencer, enhancer, Locus control region & insulator as DNA regulator regions.</p> <p> AII-17.3c Discuss of gene expression at Post transcriptional level (RNA processing, RNA stability, RNA editing & the effect of micro-RNA on mRNA)</p>
<p>AII-18</p>	<p>AII-18.<u>1</u> : Discuss Recombinant DNA technology</p> <p> AII-18.1a Explain clearly what is cloning and its steps</p> <p> AII-18.1b Discuss practical applications of recombinant DNA tech. and appreciate how molecular biology gives us new perspectives and new technologies used in diagnosis and treatment genetic diseases.</p> <p> AII-18.1c Discuss the differentiate between in vivo & in vitro amplification(PCR) and explain applications of PCR.</p> <p>AII-18.<u>2</u>: discuss genomic technologies :</p> <p> AII-18.2a Compare between genomic and cDNA libraries.</p> <p> AII-18.2b Discuss the different methods gene localization and gene sequencing</p> <p> AII-18.2c Discuss RNA and protein profiling and protein – DNA interaction mapping.</p> <p>AII-18.<u>3</u> : Explain the role of gene therapy as a therapeutic indications of</p>

	<p>DNA technology :</p> <p>AII-18.3a Discuss types of diseases can be treated with gene therapy and types of vectors used.</p> <p>AII-18.3b Explain the gene therapy strategies.</p>
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B- Intellectual skills :

On successful completion of the course, the candidate will be able to:

B1	Interpret results of molecular tests.
B2	Formulate a systematic approach for laboratory diagnosis of genetic diseases
B3	Analyze the electrophoresis bands by image analysis
B7	Make oral presentation and open discussions about scientific issues in a professional way.
B8	Estimate the risks of handling and use of chemical agents on community and environment as a part of their ethical heritage and consequently implement the standard guidelines of chemist and environmental safety.

C-Professional/practical skills:

On successful completion of the course, the candidate will be able to:

C2	Extract DNA from WBCs and tissue by trizol and amplify it using real time PCR technique.
C3	Extract RNA from tissue by trizol and analyzing it using Reverse transcriptase- real time PCR technique..
C4	Extract protein from biological samples by trizol.
C5	Analyze gene expression in certain tissue through determination of the presence and measuring proteomics (Western blot technique).
C6	Use Gel documentation system to analyze digital image of the electrophoresis gel bands.

D-Communication & Transferable skills.

On successful completion of the course, the candidate will be able to.

D1	Demonstrate competence in data presentation, time management. Statistical analysis and interpretation.
D2	Demonstrate key skills in the retrieval, preparation, analysis and interpretation of information from different sources.
D3	Make effective use of information technology e.g. web and internet. Database work
D4	Demonstrate self-direction and some originality in tackling and solving problems
D5	Work effectively both individually and in team and making appropriate use of the capacities of group members
D6	Communicate effectively, using the appropriate method with audiences of different levels of knowledge or experience.

(3) Module 3 content

Subjects	No. of teaching hours
	Lectures
1-Updates of Nucleic acid structure & function	15
2-Updates of DNA organization, replication, mutation and repair	20
3-Updates of RNA synthesis, processing & modification	15
4-Updates of Protein synthesis & genetic code	15
5-Updates of Regulation of gene expression	15
6- Updates of Recombinant DNA & Genomic technology	15
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Total teaching hours	95

Subjects	No. of Log book hours
	1) practical
Extract DNA, RNA and proteins by trizol.	20
Analyzing gene expression using Reverse transcriptase- real	25

time PCR technique..	
Analyzing DNA polymorphism using real time PCR technique..	20
Proteomics measuring by Western blot technique.	25
Analyze digital image of the electrophoresis gel bands by Gel documentation system to.	10
-----	II) Other activities
	35
Total of hours of Log book activities	135

Module4. Special topics in biochemistry

(A) Professional information

(1) Module Aims.

Educate the students the principles of different nutrient utilization with a special focusing on microelement chemistry, under nutrition and toxicity state. Also to provide students with a major insight how proteins are targeted to their destinations by signal sequences.

(2) Intended Learning Outcomes (ILOs).

A-Knowledge and Understanding

On successful completion of the course, the candidate will be able to

AII-21.	<p>AII-21.1. Discuss digestion of carbohydrates with stress on carbohydrate splitting enzymes</p> <p>.AII-21.2. Explain absorption of CHO (monosaccharides)</p> <p style="padding-left: 40px;">AII-21.2.a. Illustrate the process of absorption of sugars .</p> <p style="padding-left: 40px;">AII-21.2.b. Identify glucose transporters (GluT)</p> <p style="padding-left: 40px;">AII-21.2.c . Explain the fate of absorbed sugars with stress on fate of absorbed</p>
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glucose (sources and pathways)

AII-21.3. discuss defects in digestion and absorption of CHO including inherited disorders .

AII-21.4. Discuss digestion & absorption of lipids (TG ,PLs , Cholesterol) .

AII-21.5. Explain defects in digestion , absorption and transportation of lipids

AII-21.5.a. Explain steatorrhea (defect in digestion and absorption)

AII-21.b Explain fatty liver (defect in transportation)

AII-21.6. Explain digestion of proteins with stress on protein splitting enzymes.

AII-21.7. Discuss absorption of amino acids .

AII-21.7.a. discuss in details the carrier proteins transport system

AII-21.7.b. discuss the role of Glutathione in amino acid absorption (Gamma Glutamyl Cycle)

AII-21.8. Discuss absorption of vitamins

AII-21.8.a Explain absorption ,transport & storage of fat-soluble vitamins

AII-21.8.b Explain absorption,transport & storage of water-soluble vitamins .

AII-21.9 Discuss absorption of minerals

AII-21.9.a Explain absorption & transport of macro elements (Ca ,P ,Na , K ,Mg , Mn,Cl) .

AII-21.9.b Explain absorption , transport & storage of trace elements (Iron ,Zinc , Cu)

AII-21.10 Discuss energy requirements & its estimation by measuring the energy expenditure

AII-21.11 Explain clinical conditions of mal-nutritions .

	<p>AII-21.11.a Explain under-nutrition (marasmus & kwashiorkor)</p> <p>AII-21.11.b Explain over-nutrition (obesity, NIDDM)</p>
AII-22	<p>AII-22.1. Explain fat-soluble vitamins (active forms, synthesis, function, toxicity, deficiency)</p> <p>AII-22.2. Explain water-soluble vitamins (chemistry, function, toxicity, deficiency & co-enzyme forms of each one of vitamin B complex members).</p> <p>AII-22.3 Explain absorption, transport, storage, function, toxicity & deficiency of macro elements & trace elements.</p>
AII-23	<p>AII-23.1. Discuss intracellular trafficking</p> <p>AII-23.1.a. Identify the meaning of trafficking with stress on final protein destinations.</p> <p>AII-23.1.b. Discuss the sequences of molecules carried by proteins to target them to specific organelles.</p> <p>AII-23.1.c. Discuss the techniques used to study intracellular trafficking.</p> <p>AII-23.2 Discuss Protein sorting</p> <p>AII-23.2.a. Mention the different sorting branches (according to the site of protein synthesis).</p> <p>AII-23.2.b Discuss cytosolic sorting branch (Mitochondrial, Nuclear & Peroxisomal).</p> <p>AII-23.2.c Discuss R.E.R sorting branch (Discuss the signal hypothesis, Mention several routes by which proteins are inserted into the membrane of E.R., Explain the role of G.A in retrograde transport)</p> <p>AII-23.2.d Discuss E.R homeostasis & role of chaperon.</p> <p>AII-23.2.e Discuss unfolded protein response (UPR) & E.R degeneration (ERAD) of protein.</p> <p>AII-23.2.f Explain the process of protein degradation.</p> <p>AII-23.2.g Define the transport vesicles with special stress on its role on intracellular</p>

	<p>protein trafficking.</p> <p>AII-23.2.h Explain the process of membrane assembly .</p> <p>AII-23.2.i Mention different types of conformational diseases .</p>
AII-24	<p>AII-24.1 Illustrate the differentiation of different blood cells from hematopoietic stem cell with stress on the role of erythropoietin & growth factors in its regulation .</p> <p>AII-24.2 Enumerate important disorders affecting RBCs.</p> <p>AII-24.3 Discuss important aspects of RBCs metabolism & structure of its membrane .</p> <p>AII-24.4 Discuss the biochemical basis of ABO blood group system .</p> <p>AII-24.5 Explain different types of anemia (causes, pathogenesis ,diagnostic investigations).</p> <p>AII-24.6 Explain the oxidative stress (OS) inside the blood cells & describe the protective mechanisms against it .</p> <p>AII-24.7 Explain the major biochemical features of neutrophils with stress on its important enzymes & proteins .</p> <p>AII-24.8 Explain the role of neutrophils in acute inflammation (release of chemotactic factors , respiratory burst , adhesion by integrin & mechanism of activation).</p> <p>AII-24.9 Explain role of recombinant DNA technology in hematology .</p>

B-Intellectual skills

On successful completion of the course, the candidate will be able to

B2	Interpret laboratory reports
B3	Formulate a systematic approach for laboratory diagnosis of metabolic and genetic diseases.

A- Professional/practical skills.

On successful completion of the programme, the candidate will be able to.

C1	Measure different biological substances with chromatography (HPLC).
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C4	Extract protein from biological samples by trizol.
C5	Analyze gene expression in certain tissue through determination of the presence and measuring proteomics (Western blot technique).

D-Communication & Transferable skills

On successful completion of the course, the candidate will be able to

D1	Demonstrate competence in data presentation, time management. Statistical analysis and interpretation.
D2	Demonstrate key skills in the retrieval, preparation, analysis and interpretation of information from different sources.
D3	Make effective use of information technology e.g. web and internet. Database work
D4	Demonstrate self-direction and some originality in tackling and solving problems
D5	Work effectively both individually and in team and making appropriate use of the capacities of group members
D6	Communicate effectively, using the appropriate method with audiences of different levels of knowledge or experience.

(3) Module 4 content.

Subjects	No. of Teaching Hours
	Lectures
1-Updates of Nutrition, Digestion & absorption	16
2-Updates of Micronutrients (vitamins & minerals)	12
3-Updates of Intracellular trafficking & protein sorting	25
4-White & RBCs	12
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Total Teaching hours	65

Subjects	No. of Log book Hours
	I) practical
Measure different biological Micronutrients (vitamins & minerals) with chromatography (HPLC).	10
Protein extraction and blotting using Western blot technique.	10
II) Other activities	35
Total of hours of Log book activities	60

(4) Teaching methods of the whole course.

- 4.1. Lecture
- 4.2. Practical class
- 4.3. Small group discussion with case study and problem solving
- 4.4. Tutorial
- 4.5. Seminars
- 4.6. Workshops

(5) Assessment methods.

- 5.1. MCQ Examination for assessment of Knowledge and intellectual ILOS
- 5.2 Written exam for assessment of Knowledge and intellectual ILOS
- 5.3. Log book for activities for assessment of : transferrable skills which are accepted through attending different conferences (at least one), thesis discussions (at least one), seminars(at least 3 per month), workshops (at least one) , attending scientific lectures as well as self learning.

Assessment schedule

Written, oral, OSPE : after 6 semesters of the date MD registration

MCQ at the end of each semester

(6) References of the course.

6.1: Text books:

- Harper's Illustrated Biochemistry. 30th edition by Murray RK, Granner DK, Mayes PA, Rodwell VW, McGraw-Hill companies New York, 2015.

- Lippincott's Reviews of Biochemistry, 6th edition by Champe PC, Harvey RA, Ferrier DR, Lippincott William & Wilkins London, 2014.
- Textbooks of Medical Biochemistry, 7th edition by Chatterjea MN. and Shinde R. JAYPEE BROTHERS. New Delhi, India, 2007.
 - Pretest Biochemistry and Genetics :3rd edition by Golder N. Wilson,library of congress cataloging-in-publication data, Dallas, Texas, 2007.
 - Multiple Choice Questions in Biochemistry :2nd edition, by RC Gupta, JAYPEE BROTHERS. New Delhi, India, 2004.
 - Case Files Biochemistry :2nd edition, by TOY SEIFERT STROBEL HARMS, Mc Graw Hill, USA, 2008.
 - Board Review Series : Biochemistry,Molecular Biology and Genetics :5th edition, by T.A.Swanson, S.I.Kim, M.J.Glucksman, M.A.Lieberman, Lippincott William & Wilkins, Baltimore, USA, 2010.

6.2: Websites:

- <http://www.medlib.iupui.edu/ref/biochem.htm>
- The Biology Project (from the University of Arizona).
<http://www.biology.arizona.edu/default.html>
- Harvard Department of Molecular & Cellular Biology Links.
<http://mcb.harvard.edu/BioLinks.html>

6.3: Recommended books

- Text book of Biochemistry with Clinical Correlations 5th Ed, Devlin TM Ed.Wiley –Liss New York 2002
- Zilva Clinical Chemistry & Metabolic Medicine, 7th edition, Crook MA, Hodder Arnold, London, 2006.

(7)Facilities and resources mandatory for course completion.

- Lecture rooms: available in the department
- Laboratories: The Department has 3 laboratories for research. Instrumentation that is available for training and research use include:

- (4) spectrophotometers
- (5) High-speed centrifuges and ultracentrifuges
- (6) UV hoods
- (7) Computers for data analysis
- (8) Facilities for image analysis

- (9) PCR machines
- (10) Colorimeters
- (11) Electrophoresis equipment
- (12) Chromatography, including HPLC
- (13) ELISA reader

Total Assessment of the second part.

Percentage of each Assessment to the total mark.

Written exam	MCQ	Oral	OSPE practical	Total
160	40	100	100	400

Course coordinator: staff members of the credit

Head of the department.

Prof.Dr/FagrBazeed

Date: 1/11/2015