COURSE SPECIFICATION

A. First part MD Medical Biochemistry

A1: (Genetics)

(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:	1st part
5. Date of approval by the Department`s council	29/4/2018
6. Date of last approval of programme specification by Faculty council	
7. Course title:	Genetics
8. Course code:	BIC 604 GE
9. Total teaching hours:	60 hours
10.Total credit hours:	4 hours
11. Log book activities	0.17 hours

(B) Professional information

(1) Course Aims:

To educate the students about the basics of genetic science with its relation to different diseases& also to
provide the students with updated data concerning diagnostic techniques of different genetic diseases& gene
therapy.

(2) Intended Learning Outcomes (ILOs):

A- Knowledge and Understanding

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

AI-1	- **AI-1.1** Define branches of Genetics - **AI-1.2** Discuss importance of Genetics in Medicine - **AI-1.3** Recognize Classification of Genetic disease
AI-2	AI-2.1- Identify cell division **AI-2.2 -** Describe cell cycle and its strict regulatory control. **AI-2.3 -** Recognize the causes & mechanisms of cell cycle arrest. AI-2.4 - illustrate structure & classification of human chromosomes. AI-2.5 - Explain different techniques of chromosome analysis. AI-2.6 - Recognize the possible chromosome abnormalities.
AI-3	Discuss the principle of Mendelian's law of inheritance
AI-4	**AI-4.1** Recognize the Organization of human genome(structure& packing) **AI-4.2** Defining Genes & Genetic code
AI-5	**AI-5.1** Describe Monogenic (single gene) or Mendelian inheritance (Autosomal dominant Inheritance, Autosomal Recessive Inheritance & Sex linked inheritance) **AI-5.2** Recognize inheritance of ABO Blood groups **AI-5.3** Describe Mitochondrial inheritance **AI-5.4** Recognize Polygenic& Multifactorial inheritance **AI-5.5** Case Study (Huntington disease, Marfan syndrome, cystic fibrosis, fragile X syndrome &Duchene Muscular dystrophy)

AI-6	Discuss the relationship between Genes & Biochemistry in the form of studying the genetic basis of these diseases **(**Phenyl ketonuria, Albinism, Galactosemia, Familial hypercholesterolemia, Hurler's syndrome& Wilson's disease)
AI-7	**AI-7.1** Recognize HB structure **AI-7.2** Recognize HB genes **AI-7.3** Discuss the genetic basis of Sickle Cell disease **AI-7.4** Explain the genetic basis of Thalasemias
AI-8	**AI-8.1** Discuss Oncogenes **AI-8.1.a** Recognize Role of Growth factors& their receptors in cancers **AI-8.1. b** Recognize Virus & cancer genes **AI-8.2** Explain Tumor suppressor genes **AI-8.3** Explain DNA repair genes **AI-8.4** discuss Genetics of apoptosis **AI-8.5** Case study (colorectal cancer & familial breast cancer)
AI-9	**AI-9.1** Explain methods of Diagnosis of Genetic disease **AI-9.2** Explain methods of Management of Genetic disease
AI-10	**AI-10.1** Recognize Indication of prenatal Diagnosis **AI-10.2 C**lassify techniques of prenatal Diagnosis

AI-10.3 Describe treatment of genetic disease **AI-10.4** Explain Gene Therapy

B- Intellectual skills

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

B4	Make oral presentation and open discussions about scientific issues in a professional way.

D. Communication &Transferable skills

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

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) Course content:

Subjects	Teaching hours
	Lectures
Introduction of genetics	4
Chromosomes	4
Mendelian' law of inheritance	4
Molecular genetics	6
Modes of inheritance	6
Genes & biochemistry	8
Genetics & Haemoglobin disorders	6
Genes & cancer	10
Genetic counseling	6
Prenatal Diagnosis & treatment of genetic	disease 6
Total Teaching Hours	60

Log book activities	
Teaching Hours	5

(4) Teaching methods:

4.1: Lecture

4.2: Small group discussion with case study and problem solving

4.3: Tutorial

4.4: Seminars

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.

5.4: The supervisor requires certain exam that are evaluated and signed by the supervisors in the log

book (without marks).

Percentage of each Assessment to the total mark:

Written exam: 80 Marks

MCQ exam: 20 Marks

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.

•Medical Genetics, 1st edition by G.P. Pal, A.I.T.B.S publishers, Delhi, India, 2009.

•Medical Genetics, 1st edition by Ian D. Young, Oxford University press Inc., New York, 2010.

•Introduction to genetics principles, by David R. Hyde, McGraw Hill, New York, 2009.

•Case Files Biochemistry :2ndedition, by TOY SEIFERT STROBEL HARMS, McGraw Hill, USA, 2008.

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

7.Facilities and resources mandatory for course completion:

- Lecture rooms: available in the department

Course coordinator: staff members of the credit

Head of the department: Prof. Ayman El-Baz

COURSE SPECIFICATION

A2:(Special course in Medical Biochemistry & Molecular Biology)

(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:	1st part
5.Date of approval by the Department`s council	29/4/2018
6.Date of last approval of programme specification by Faculty council	
7.Course title:	**Special course in Medical Biochemistry & Molecular Biology**
8.Course code:	BIC 604 SB
9.Total teaching hours:	15 hours
10.Total credit hours:	1 hour
12.Log book activities	0.17 hour

(B) Professional information

(1) Course Aims:

To educate students about the basics of aging, stem cells, obesity and bioinformatics and their different

biochemical basis and theories, also to provide the students with updated data concerning

recent

applications.

(2) Intended Learning Outcomes (ILOs):

A-Knowledge and Understanding

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

AI-11	**AI-11.1** Define aging **AI-11.2** Discuss aging theories **AI-11.3** Describe secrets of aging including: **AI-11.3.a** Free radical (oxidative stress) theories (Mitochondria and ROS generation, ROS and biomolecules damage, ROS and immune response, ROS and cytokines) **AI-11.3.b** Mitochondrial changes. **AI-11.3.c** Accumulation of aberrant proteins in the cytosol. **AI-11.3.d** Chemical damage to macromolecules. **AI-11.3.e** DNA repair errors. **AI-11.3.f** Somatic mutations and altered transcription of specific genes **AI-11.3.g** Glucose cross linking **AI-11.3.h** Role of HSP, hormones, growth factors in aging **AI-11.4** Explain pathways of senescence (telomere dependent pathway induced by stress signals) **AI-11.5 Explain** Role of Antioxidant , Caloric or dietary restriction, Hormone replacement in retarding aging process **AI-11.6 Explain** Role of dopamine receptor in aging AI-11.7 **Recognize** telomerase regulation

AI-12	**AI-12.1 D**iscuss Stem cells **AI-12.2 Recognize** Characters of stem cell (self renewal& potency) **AI-12.3 Recognize** Classification of stem cell **AI-12.4 Recognize** Induced pluripotent stem cells **AI-12.5 Describe** Stem cell plasticity **AI-12.6 Illustrate** Updating in regulation of stem cell proliferation/differentiation **AI-12.7** Describe Stem cell signaling pathways **AI-12.8 Describe** Updating in application of stem cells (in research & therapeutic fields) **AI-12.9 Recognize** Technical advantages& disadvantages of stem cell for therapeutic Purposes **AI-12.10** Define Leukemic Stem Cells **AI-12.11** Explain Cancer stem cells
AI-13	**AI-13.**1 Define the Human Genome Project **AI-13.2 Recognize** the prominent examples of bioinformatics resources (GenBank, UniProt, The protein database, HapMap database, ENCODE project, Entrez Gene &

	dbGAP) **AI-13.3** Define the concept of Computational biology & its applications **AI-13.3.a Recognize** BLAST as a method to identify unknown proteins **AI-13.3.b** Discuss Computer –Aided drug design **AI-13.3.c** Recognize Creation of virtual cell to be used in diagnosis & treatment of diseases.

AI-14	**AI-14.1** Explain assessment of obesity. **AI-14.2** Discuss regulation of body weight. **AI-14.3** Explain molecules that influence obesity. **AI-14.4** Discuss metabolic changes observed in obesity. **AI-14.5** Discuss regulation of body weight. **AI-14.6** Illustrate the diseases associated with obesity.
AI-15	AI-15.1 Discuss definitions of nanotechnology. AI-15-2 Enumerate different Applications of nanotechnology AI-15.3 Fabrication at nano scale AI-15.4 Nanoparticles (NPs) AI-15.5 Nanomedicine -Definition - Nanodevices - Application of nanotechnology in medicine -Nanomedicine : Application areas - Risk of nanotechnology - Risk assessment of nanotechnology

B- Intellectual skills

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

B4	Make oral presentation and open discussions about scientific issues in a professional way.

D- Communication &Transferable skills

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

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) Course content:

Subjects	Teaching Hours
	Lectures
Aging	3
Stem cell	3
Bioinformatics	3
Obesity	3
Nanotechnology	3
Total Teaching Hours	15

Log book activities	
Teaching Hours	5

(4) Teaching methods:

4.1: Lecture

4.2: Small group discussion with case study and problem solving

4.3: Tutorial

4.4: Seminars

(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.

Percentage of each Assessment to the total mark:

Written exam: 80 Marks

MCQ exam: 20 Marks

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, 4th edition by Champe PC, Harvey RA, Ferrier DR,

Lippincott William & Wilkins London, 2008.

•Textbooks of Medical Biochemistry, 7th edition by Chatterjea MN.andShinde R. JAYPEE BROTHERS. New Delhi, India, 2007.

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

7.Facilities and resources mandatory for course completion:

- Lecture rooms: available in the department

Course coordinator: staff members of the credit

Head of the department:

Prof. / Ayman El-Baz

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	29/4/2018
6.Date of last approval of programme specification by Faculty council	

7.Course title:	Medical Biochemistry & Molecular Biology (advanced course)
8.Course code:	BIC 604
9.Total credit hours:	Lectures= 23 hour. Log book: (Practical= 10 hour & Other activities= 4.66 hour).

Module1: 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	**AII-2.1 D**escribe methods used in analyzing & determination of sequence of proteins and peptides. **AII-2.2** Identify proteome & proteomics (definition & techniques) **AII-2.3 D**escribe the four orders of protein structure with stress on the stabilizing factors & techniques used in determining the three dimensional structure of protein. **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)
AII-3	**AII-3.1** Describe collagen as an example of fibrous proteins (types, structure, biosynthesis & nutritional and genetic disorders of collagen maturation).

AII-4	**AII-4.1**. describe myoglobin (structure ,function & oxygen dissociation curve) **AII-4.2.** describehaemoglobin (structure , types) **AII-4.3**. definehaemoglobin function (oxygen dissociation curve, conformational changes & role of 2,3 biphosphoglycerate) **AII-4.4.** mention mutations affecting human haemoglobin and resulting diseases.
AII-5	**AII-5.1** identify characters and types of enzymes. **AII-5.2**. compare different mechanisms to facilitate enzyme catalysis. **AII-5.3** Identify role of prosthetic groups, cofactors and co-enzymes and their types. **AII-5.4** identify isoenzymes **AII-5.5** Explain how catalytic activity of enzymes facilitate their detection. **AII-5.6** Demonstrate application of enzymes in diagnosis of diseases. **AII-5.7** Describe types of chemical reactions and factors affecting the reaction rate. **AII-5.7.a**. define free energy and activation energy. **AII-5.8.** Discuss kinetics of enzymatic catalysis with stress on factors affecting,Michaelis Menten and Hill equation. **AII-5.8.a** Distinguish competitive and non competitive inhibition. **AII-5. 9** define types of enzyme-catalyzed reactions **AII-5.10** recognize role of enzymes in drug discovery. **AII-5.11** Explain regulation of enzyme at both the quantity&catalytic activity levels.
AII-19	**AII-19.1** Describe Steroid synthesis **AII-19.2** Describe Catecholamines synthesis **AII-19.3** Describe Thyroid synthesis **AII-19.4** Describe Hormone synthesis from larger peptide precursors

AII-20	**AII-20.1**- Explain the target cell concept **AII-20.2**- Describe the sensory machinery that initiate signaling cascades including: * Signals / ligands * Receptors : 1- Intracellular receptors (cytoplasmic& nuclear) 2- Membranous receptors * Ion / ligand gated channels * G protein coupled receptors * Enzyme linked receptors

	AII-20.3- Analyze the propagation of signals to the cell interior (signal transduction pathway) * c AMP signaling pathway * Phosphoinositide / Ca++ signaling pathway * c GMP signaling pathway * RAS / MAP Kinase signaling pathway * PI_3K / AKT /m Tot signaling pathway **AII-20.4-** Describe cell survival signaling pathway **AII-20.5-** Analyze oncogenic signaling pathway

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	Make oral presentation and open discussions about scientific issues in a professional way.

B5	Analyze the electrophoresis bands by image analysis.
B7	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	Separate some biological parameters by chromatography (HPLC).
C2	Perform RNA extraction.
C3	Perform reverse transcriptase PCR (RT-PCR).
C4	Perform quantitative real-time PCR (qRT-PCR).
C5	Extract protein from biological samples by trizol.
C6	Analyze gene expression using Western blot technique.
C7	Use Gel documentation system to analyze digital image of the electrophoresis gel bands.

D- Communication &Transferable skills

D1	Demonstrate competence in data presentation. 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.
D7	Conduct thesis and scientific paper.

(4) Course content:

Subjects	**No. of teaching hours**
Lectures	
1-Updates of Amino acids &peptides	3
2-Updates of structure of protein & protein folding	4
3-Updates of protein traffic & sorting	10
4-Updates of hemoglobin & myoglobin	2
5-Updates of extracellular matrix	7
6-Updates of Enzymes (action, kinetics, regulation)	9
7-Diversity of endocrine system	7
8-Hormone action & signal transduction	7
9- Updated essay topic	5
Total Teaching Hours	**54**

Log Book	
Subjects	**No. of teaching hours**
I) Practical	
1. Separation of some biological parameters by chromatography (HPLC).	10
2. RNA extraction.	10
3. Reverse transcriptase PCR (RT-PCR).	5
4. Quantitative real-time PCR (qRT-PCR).	10

5. Extract protein from biological samples by trizol.	10
6. Western blot technique.	20
7. Use Gel documentation system to analyze digital image of the electrophoresis gel bands.	10
II) other activities	**35**
Total Teaching Hours	110

(4) Teaching methods:

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.

(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. andShinde R. JAYPEE BROTHERS. New Delhi, India, 2007.

•Pretest Biochemistry and Genetics :3rdedition by Golder N. Wilson,library of congress cataloging-in-publication data, Dallas, Texas, 2007.

•Multiple Choice Questions in Biochemistry :2ndedition, by RC Gupta,JAYPEE BROTHERS. New

Delhi, India, 2004.

•Case Files Biochemistry :2nd edition, by TOY SEIFERT STROBEL HARMS, McGraw 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:

(1) spectrophotometers
(2) High-speed centrifuges and ultracentrifuges
(3) UV hoods
(4) Computers for data analysis
(5) Facilities for image analysis
(6) PCR machines
(7) Colorimeters
(8) Electrophoresis equipment
(9) Chromatography, including HPLC, ELISA reader

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	**AII-6-1** Discuss the redox potential. **AII-6-2** Discuss oxidoreductases
AII-7	**AII-7-1 Discuss Electron transport chain** **AII-7-1-1** Differentiate between energy production in biological and non biological systems **AII-7-1-2** Identify Components of ETC **AII-7-1-3** Explain Sequence of events **AII-7-2 Discuss Oxidative phosphorylation** **AII-7-2-1 Discuss** Definition, site and energy production **AII-7-2-2** Explain Theories of ATP synthesis **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-7-2-7Explain** Oxidation of cytoplasmic NADH **AII-7-3 Discuss and interpret bioenergetics** (definition, first law of thermodynamics, gibbs free energy and standard free energy) **AII-7-4 Recognize ATP (sources and biological importance)** **AII-7-5 Describe Low and high energy bond**

AII-8	**AII-8-1 describe Glycolysis** (definition, site, steps, biomedical and clinical importance, regulation, energetic and clinical aspects) **AII-8-2 Recognize Pyruvate metabolism with stress on Oxiadative decarboxylation** (definition, site, steps, regulation) **AII-8-3 Discuss Citric acid cycle** (definition, site, steps, biomedical importance, regulation and inhibitors, energetic, clinical aspects and role of vitamins) **AII-8-4 Discuss Glycogen metabolism including:** **AII-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 **AII-8-5 Define and recognize Gluconeogenesis** (definition, site, substrates and steps, biomedical importance, regulation and clinical aspects)

	AII-8-6 Describe Hexosemonophosphate pathway (definition, site, biomedical importance, function of NADP, regulation and clinical aspects) **AII-8-7 Describe Uronic acid pathway** (definition, site, importance, pathways of UDPG, biosynthesis of amino sugars) **AII-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) **AII-8-9 Describe Insulin** (Structure, synthesis, mechanism of action, regulation of secretion, metabolic effects and catabolism) **AII-8-10 Describe Glucagon** (Structure, mechanism of action, regulation of secretion and metabolic effects) **AII-8-11 Interpret Blood glucose level** (regulation of blood glucose level and clinical aspects; glucosurira, hyper and hypoglycemia) **AII-8-12 Interpret and differentiate between types of Diabetes milletus** **Definition, incidence, pathogenesis, metabolic changes and treatment of both types** **Complications** (acute and chronic and its pathogenesis) **AII--8-13 Discuss Glycoproteins , glycosaminoglycans and proteoglycans** **AII-8-13-1 Discuss Glycosaminoglycans** (structure, classification, synthesis, degradation and mucopolysaccharaidosis) AII-8-**13-2** Discuss **Proteoglycans** (structure) AII-8-**13-3** Discuss **Glycoproteins** **(**structure, synthesis, degradation and biomedical and clinical importance)

AII-9	**AII-9-1Describe 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 **AII-9-2 Describe and compare between different types of Fatty acid oxidation** **AII-9-2-1 Explain** B_oxidation , Alpha oxidation, Omega oxidation (definition, site, steps) **AII-9-2-2 Explain** Oxidation of unsaturated FA **AII-9-3 Recognize Active acetate (sources and fate)** **AII-9-4 Discuss Ketone bodies metabolism including:**

	AII-9-4-1 Ketogenesis (definition, site, steps, biomedical importance andregulation) **AII-9-4-2** Ketolysis (definition, site, steps, biomedical importance and regulation) **AII-9-4-3** Ketosis(definition, pathogenesis, causes and effects) **AII-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. **AII-9-6 Discuss Eicosanoids metabolism** (Definition, members, synthesis, biological actions, clinical aspects) **AII-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-9-7-4Discuss** Steroid hormones (synthesis, secretion and mechanism of action) **AII-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 **AII-9-9 Describe role of adipose tissue in lipid metabolism with stress on hormonal regulation** **AII-9-10 Discuss Fatty liver** (definition, causes ,pathogenesis and lipotropic factors)

AII-10	**AII-10-1**describe amino acid pool **AII-10-2** demonstrate catabolic pathways of amino acids (transamination deamination-decarboxylation-transamidation) **AII-10-3 Mention**understanding sources & fates of ammonia **AII-10-4** discuss urea biosynthesis (steps-regulation-metabolic disorders) **AII-10-5** Explain the nitrogen balance **AII-10-6** recognize biosynthesis of non essential amino acids **AII-10-7** describe catabolism of carbon skeleton of a.a. **AII-10-8** discuss conversion of amino acids to specialized product

	AII-10-8a-describe (structure-synthesis-regulation-disorders) of porphyrin **AII-10-8b**-list nitrogen containing compounds

AII-11	**AII-11-1**-discuss synthesis of purine nucleotide including: a-denovo pathway (steps-regulation) b-salvage pathway c-deoxyribonucleotide synthesis(steps-regulation) **AII-11-2** describe catabolism of purin nucleotides **AII-11-3** explain metabolic disorders of purine metabolism (hypouricemia hyperuricemia) **AII-11-4** discuss pyrimidine synthesis &degradation including: **AII-11-4-a**-denovo pathway (steps-regulation) **AII-11-4-b**-salvage pathway **AII-11-4-c**-catabolism **AII-11-5** Mention synthetics base analoges used in chemotherapy.
AII-12	**AII-12-1** Describe enzyme change and metabolic fuels in fed &fasting state. **AII-12-2** describe role of (liver-adipose tissue-muscle-brain)in fed &fasting state. **AII-12-3** describe the metabolic changes in (DM ,pregnancy,lactation). **AII-12-4 Explain** metabolic pathways regulated at different levels of organization (at tissue & organ level).

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 disease.

B4	Make oral presentation and open discussions about scientific issues in a professional way.
B7	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	Separate some biological parameters by chromatography (HPLC).

C2	Perform RNA extraction.
C3	Perform reverse transcriptase PCR (RT-PCR).
C4	Perform quantitative real-time PCR (qRT-PCR).
C5	Extract protein from biological samples by trizol.
C6	Analyze gene expression using Western blot technique.
C7	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. 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
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.
D7	Conduct thesis and scientific paper.

(3) Course content:

Subjects	**No. of teaching hours**
Lectures	
1.Water metabolism & acid-base balance	4
2-Updates of Biological oxidation & bioenergetics	10
3. Updates of chemistry & metabolism of carbohydrates, glycoproteins and diabetes mellitus.	40
4. Updates of chemistry & metabolism of lipids	43
5. Updates of metabolism of protein & individual amino acids	40
6- Updates of Nucleic acid metabolism	5
7. Porphyrin metabolism & bile pigment.	5
8- Updates of metabolic integration & feed-fast cycle	5
9- Updated essay topic	5
Total teaching hours	**157**

Log Book	
Subjects	**No. of teaching hours**
I) Practical	
1. Separation of some biological parameters by chromatography (HPLC).	10
2. RNA extraction.	10
3. Reverse transcriptase PCR (RT-PCR).	5
4. Quantitative real-time PCR (qRT-PCR).	10
5. Extract protein from biological samples by trizol.	10
6. Western blot technique.	20
7. Use Gel documentation system to analyze digital image of the electrophoresis gel bands.	10
II) other activities	**35**
Total Teaching Hours	110

(4) Teaching methods:

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.

(6) References of the course:

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(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:

(10) spectrophotometers

(11) High-speed centrifuges and ultracentrifuges

(12) UV hoods

(13) Computers for data analysis

(14) Facilities for image analysis

(15) PCR machines

(16) Colorimeters

(17) Electrophoresis equipment

(18) Chromatography, including HPLC, ELISA reader

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	**AII-13.1** Discuss different levels of DNA structure (DNA primary& different types of DNA secondary structure). **AII-13.2** Recognizing the definition & mechanisms of DNA denaturation & renaturation as methods of analyzing DNA structure. **AII-13.3** Differentiation between DNA & RNA. **AII-13.4** Enumerat different types of RNA with explaining the structure& function of each one
AII-14	**AII-14.1** Discuss the chromatin structure with explanation of the histone proteins ,nucleosomal structure& chromatin structure. **AII-14.2** Describe the high order structure of the chromatin & its incorporation in the activity state of the chromatin. **AII-14.3** Explain the DNA repetitive & non repetitive regions. **AII-14.4** Compare 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). **AII-14.6** Discuss DNA replication. **AII-14.6a** Defining the replication with recognizing the steps of replication. **AII-14.6b** Differentiating types of DNA polymerase in eukaryotes&Prokaryotes& the function of each one. **AII-14.6c** Recognizing the replication polarity. **AII-14.6d** identifying Timing of replication in the cell cycle & its

	application. **AII-14.7** discuss DNA mutation & repair. **AII-14.7a** Recognizing the definition, causes & effect of DNA mutation. **AII-14.7b** mention different types of DNA repair. **AII-14.7c** Explain the clinical conditions associated with impaired repair.

AII-15	**AII-15.1: Discuss** RNA synthesis:- **AII-15.1a** Describe the classification of RNA and how it is synthesized from DNA template by RNA polymerase. **AII-15.1b** Compare between eukaryotic and prokaryotic DNA dependent RNA polymerase (also know the difference between euik and prok promoters). **AII-15-1c** Explain how RNA synthesis is cyclical process involve RNA chain initiation, elongation and termination. **AII-15.1d** Discuss different transcription factors and discuss the components, formation, assembly of basal transcription complex. **AII-15.1e** Recognize signals that regulate transcription termination and clarify how termination occurs either by Rho factor independent or Rho factor dependent manner. **AII-15.2:**Mention how RNA molecules usually processed before they become functional : **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. **AII-15.2b** Recognize how tRNA, rRNA are processed. **AII-15.3** discuss how RNA is modified after it's synthesis. **AII-15.3a** Recognize copping, tailing, splicing and RNA editing of mRNA. **AII-15.3b** discuss post transcriptional modification of tRNA and rRNA. **AII-15.3c** Explain how RNA can acts as a catalyst. **AII-15.3d** discuss micro-RNA synthesis & their role in quality control of mRNA in P bodies.

AII-16	**AII-16.1 :**Explain different features of genetic code **AII-16.2 :**Explain the three phases of protein synthesis: initiation with formation of initiation complex, elongation and termination. **AII-16.3 :**Discuss the regulation and control of protein synthesis

	AII-16. 3 a Explain control at the level of gene expression. **AII-16.3b** Explain the regulation and control of initiation **AII-16.3c** Explain how protein synthesis respond to environmental threats. **AII-16.3d** Explain how viruses can affect protein synthesis. **AII-16.3e** Recognize post translational processing affects the activity of synthesized protein. **AII-16.3f** Describe the effect of Antibiotics on bacterial protein synthesis.
AII-17	**AII-17.1** Classify types of genes according to the mechanism of their expression. **AII-17.2** recognize different types of regulation of gene expression in prokaryotes **AII-17.2a** Recognize the catabolic regulation (lac operon) **AII-17.2b** Explain co-repression (tryptophan operon) **AII-17.2c** Explain genetic switching (λ phage cycle) **AII-17.3** classify the levels of euokaryotic regulation of gene expression. **AII-17.3a** Discuss of gene expression at the Genomic level (gene rearrangement &gene amplification) **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. **AII-17.3c** Discuss of gene expression at Post transcriptional level (RNA processing, RNA stability, RNA editing& the effect of micro RNA on mRNA)

AII-18	**AII-18.1 :** Discuss Recombinant DNA technology **AII-18.1a** Explain clearly what is cloning and its steps **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. **AII-18.1c** Discuss the differentiate between in vivo & in vitro amplification(PCR) and explain applications of PCR. **AII-18.2:** discuss genomic technologies : **AII-18.2a** Compare between genomic and cDNA libraries. **AII-18.2b** Discuss the different methods gene localization and gene sequencing **AII-18.2c** Discuss RNA and protein profiling and protein – DNA interaction mapping.

	AII-18.3 : Explain the role of gene therapy as a therapeutic indications of DNA technology : **AII-18.3a** Discuss types of diseases can be treated with gene therapy and types of vectors used. **AII-18.3b** Explain the gene therapy strategies.

B- Intellectual skills :

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

B1	Interpret results of molecular tests.
B3	Formulate a systematic approach for laboratory diagnosis of genetic diseases
B4	Make oral presentation and open discussions about scientific issues in a professional way.
B5	Use Computer to analyze the electrophoresis bands by image analysis
B7	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	Separate some biological parameters by chromatography (HPLC).
C2	Perform RNA extraction.
C3	Perform reverse transcriptase PCR (RT-PCR).
C4	Perform quantitative real-time PCR (qRT-PCR).
C5	Extract protein from biological samples by trizol.
C6	Analyze gene expression using Western blot technique.
C7	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. 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) Course content

Subjects	**No. of teaching hours**
Lectures	
1-Updates of Nucleic acid structure & function	10
2-Updates of DNA organization, replication, mutation and repair	12
3-Updates of RNA synthesis, processing & modification	12
4-Updates of Protein synthesis & genetic code	12
5-Updates of Regulation of gene expression	12
6- Updates of Recombinant DNA & Genomic technology	10
7. Oncology (oncogenes & tumor markers).	4
8- Updated essay topic	5
Total teaching hours	**77**

Log Book	
Subjects	No. of teaching hours
I) Practical	
1. Separation of some biological parameters by chromatography (HPLC).	10
2. RNA extraction.	10
3. Reverse transcriptase PCR (RT-PCR).	5
4. Quantitative real-time PCR (qRT-PCR).	10
5. Extract protein from biological samples by trizol.	10
6. Western blot technique.	20
7. Use Gel documentation system to analyze digital image of the electrophoresis gel bands.	10
II) other activities	35
Total Teaching Hours	110

(4) Teaching methods:

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.

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(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:

(19) spectrophotometers
(20) High-speed centrifuges and ultracentrifuges
(21) UV hoods
(22) Computers for data analysis
(23) Facilities for image analysis
(24) PCR machines
(25) Colorimeters
(26) Electrophoresis equipment
(27) Chromatography, including HPLC, ELISA reader

Module4. Special topics in Biochemistry

(A) Professional information

(28) 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.

(29) Intended Learning Outcomes (ILOs):

A-Knowledge and Understanding

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

AII-21.	**AII-21.1.** Discuss digestion of carbohydrates with stress on carbohydrate splitting enzymes . **AII-21.2.** Explain absorption of CHO (monosaccharides)

	AII-21.2.a. Illustrate the process of absorption of sugars . **AII-21.2.b**. ldentify glucose transporters (GluT) **AII-21.2.c** . Explain the fate of absorbed sugars with stress on fate of absorbed glucose (sources and pathways) **AII-21.3.** discuss defects in digestion and absorption of CHO including inherited disorders . **AII-21.4.** Discuss digestion &absorotion 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-nutrition . **AII-21.11.a** Explain under-nutrition (marasmus &kwashiorkor) **AII-21.11.b** Explain over- nutrition (obesity , NIDDM)

AII-22	**AII-22.1.** Explain fat- soluble vitamins (active forms , synthesis ,function ,toxicity , deficiency) **AII-22.2.** Explain water –soluble vitamins (chemistry ,function ,toxicity , deficiency & co enzyme forms of each one of vitamin B complex members). **AII-22.3** Explain absorption ,transport , storage , function ,toxicity & deficiency of marcoelements & trace elements .

AII-23	**AII-23.1. Discuss intracellular trafficking** **AII-23.1.a**. Identify the meaning of trafficking with stress on final protein destinations. **AII-23.1.b.** Discuss the sequences of molecules carried by proteins to target them to specific organelles. **AII-23.1.c.** Discuss the techniques used to study intracellular trafficking. **AII-23.2 Discuss Protein sorting** **AII-23.2.a**. Mention the different sorting branches (according to the site of protein synthesis) . **AII-23.2.b** Discuss cytosolic sorting branch (Mitochondrial, Nuclear &Peroxisomal). **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) **AII-23.2.d** Discuss E.R homeostasis & role of chaperon . **AII-23.2.e** Discuss unfolded protein response (URP) & E.R degeneration (ERAD) of protein. **AII-23.2.f** Explain the process of protein degradation. **AII-23.2.g** Define the transport vesicles with special stress on its role on intracellular protein trafficking. **AII-23.2.h** Explain the process of membrane assembly . **AII-23.2.i** Mention different types of conformational diseases .
AII-24	Discuss muscle and the extracellular matrix
AII-25	**AII-25.1** Illustrate the differentiation of different blood cells from hematopoietic stem cell with stress on the role of erythropoietin & growth factors in its regulation . **AII-25.2**Enumerate important disorders affecting RBCs. **AII-25.3** Discuss important aspects of RBCs metabolism & structure of its membrane . **AII-25.4** Discuss the biochemical basis of ABO blood group system . **AII-25.5** Explain different types of anemia (causes, pathogenesis ,diagnostic investigations). **AII-25.6** Explain the oxidative stress (OS) inside the blood cells & describe the protective mechanisms against it . **AII-25.7** Explain the major biochemical features of neutrophils with stress on its

	important enzymes & proteins. **AII-25.8** Explain the role of neutrophils in acute inflammation (release of chemotactic factors, respiratory burst, adhesion by integrin & mechanism of activation). **AII-25.9** Discuss types, synthesis and different functions of plasma proteins. **AII-25.10** Explain role of recombinant DNA technology in hematology. **AII.25**.11 study Plasma Proteins & their Functions **AII.25**.12 discuss Iron metabolism (absorption and storage) **AII.25**.13 explain Copper metabolism (absorption and storage) **AII.25**.14 discuss the deficiency of alpha1-Antitrypsin as one of Plasma Proteins **AII.25**.15 Describe Amyloidosis **AII.25**.16 describe Hemostasis & Thrombosis (Phases, Types of Thrombi& Intrinsic & Extrinsic Pathways)**.** **AII.25**.17 Describe the Functions of the Proteins Involved in Blood Coagulation. **AII.25**.18 enumerate Hereditary Bleeding Disorders **AII.25**.19 describe Activation of Platelets &role of Aspirin as an Antiplatelet Drug **AII.25**.20 discuss the regulation of Circulating Thrombin with stress on Antithrombin& Coumarin Anticoagulants **AII.25**.21 describe role of Plasmin in Hemostasis **AII.25**.22 explain the role of Endothelial Cells Hemostasis **AII.25**.23 enumerate Laboratory Tests Measure Coagulation, Thrombolysis, & Platelet Aggregation

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.

C- Professional/practical skills:

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

C1	Separate some biological parameters by chromatography (HPLC).
C2	Perform RNA extraction.
C3	Perform reverse transcriptase PCR (RT-PCR).
C4	Perform quantitative real-time PCR (qRT-PCR).
C5	Extract protein from biological samples by trizol.
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On successful completion of the course, the candidate will be able to

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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.

(30) Course content:

Subjects	**No. of Teaching Hours**
Lectures	
1-Updates of Micronutrients (vitamins & minerals)	7
2- Muscle and the extracellular matrix	7
3- Red blood cells	4
4- White blood cells	4
5- Plasma proteins &immunoglobulins	5
6- Haemostasis and thrombosis	5
7- Xenobiotics and detoxification	4
8- Free radicals and antioxidants	4
9- Biological transport and cell membrane	10
10- Apoptosis	2
11- Updated essay topic	5
Total Teaching hours	**57**

Log Book	
Subjects	**No. of teaching hours**
I) Practical	
1. Separation of some biological parameters by chromatography (HPLC).	10
2. RNA extraction.	10
3. Reverse transcriptase PCR (RT-PCR).	5
4. Quantitative real-time PCR (qRT-PCR).	10
5. Extract protein from biological samples by trizol.	10
6. Western blot technique.	20
7. Use Gel documentation system to analyze digital image of the electrophoresis gel bands.	10

II) other activities	**35**
Total Teaching Hours	110

(4) Teaching methods:

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(31) spectrophotometers

(32) High-speed centrifuges and ultracentrifuges

(33) UV hoods

(34) Computers for data analysis

(35) Facilities for image analysis

(36) PCR machines

(37) Colorimeters

(38) Electrophoresis equipment

(39) Chromatography, including HPLC

(40) 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. / Ayman El-Baz

Date: 29/4/2018