COURSE SPECIFICATION

(Advanced Medical Biochemistry &Molecular Biology)

(Basic level II)

Faculty of Medicine– Mansoura University

(A) Administrative information

(1) Programme offering the course:	Master degree in Medical Biochemistry programme
(2) Department offering the programme:	Medical Biochemistry Department
(3) Department responsible for teaching the course:	Medical Biochemistry Department
(4) Part of the programme:	Second 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:	Advanced Medical Biochemistry & Molecular Biology (Basic level II)
(8) Course code:	BIC 504ad
(9) Total teaching hours:	Lectures:195 hrs Practical:240 hrs
(10) Total credit hours:	13 hours Lectures 8 hours practical

(B) Professional information

(1) Course Aims:

Provide the candidate with a recent knowledge in modern biochemistry and molecular biology, enabling recent graduates from the Master's program to found technical positions in academic and labs, pursued careers in teaching, science writing and editing, or have gone on to advanced studies for the PhD. Degree.

(2) Intended Learning Outcomes (ILOs):

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

A- Knowledge and Understanding:

AII.1	**AII.1.1** Define water as an Ideal Biologic Solvent **AII.1.2** Study Covalent & Noncovalent Bonds Stabilize Biologic Molecules **AII.1.3** Define PH &its calculation **AII.1.4** Describe buffer system in the body&its function
AII.2	**AII.2.1** define classification and strucrure of monosaccharides **AII.2.2** define derivatives of monosaccharides **AII.2.3** define disaccharides **AII.2.4** define polysaccharides(classification, homopolysaccharides, heteropolysaccharides "GAGs" **AII.2.5** Describe strucure, importance and classification of lipids **AII.2.6** Discuss structure and function of phospholipids, glycolipids , sulpholipids and lipoproteins **AII.2.7** Define structure and function of derived lipids **AII.2.8** recognize chemistry and function of carotenes **AII.2.9** Describe importance , classification , general properties of protein **AII.2.10** Describe Structure, classification , properties of amino acids **AII.2.11** Describe protein strucure, protein folding and protein misfolding
AII.3	**AII.3**.1 Describe digestion, absorption of CHO and glucose uptake by tissues. **AII.3**.2 Describe glycolysis (definition, site, steps, biomedical and clinical importance,

	regulation, energetic and clinical aspects) **AII.3**.3 discuss gluconeogenesis (defination, site, importance, gluconeogenic substrates , steps, regulation) **AII.3**.4 discuss glycogen metabolism • Structure and function of glycogen • Glycogenesis (definition, site and steps) • Glycogenolysis (definition, site and steps) • Regulation of glycogen metabolism • Glycogen storage disease **A**II.3.5 Recognize Pyruvate metabolism with stress on Oxiadative decarboxylation (definition, site, steps, regulation) **A**II.3.6 Describe citric acid cycle(definition, site, steps, biomedical importance, regulation and inhibitors, energetic, clinical aspects and role of vitamins) **A**II.3.7 discuss hexose monophosphate shunt (definition, site, biomedical importance, function of NADP, regulation and clinical aspects) **A**II.3.8 discuss uronic acid pathway(definition, site, importance, pathways of UDPG, biosynthesis of amino sugars) **A**II.3.9 Discuss Metabolism of mono and disaccharides • Fructose metabolism (biomedical importance, conversion of fructose to glucose, conversion of glucose and mannose to fructose and inborn errors of fructose metabolism) • Galactose metabolism (biomedical importance, conversion of galactose to glucose, conversion of glucose to galactose and inborn errors of galactose metabolism) **A**II.3.10 Describe Insulin (Structure, synthesis, mechanism of action, regulation of secretion, metabolic effects and catabolism) **A**II.3.11Describe Glucagon (Structure, mechanism of action, regulation of secretion and metabolic effects) **A**II.3.12 Interpret Blood glucose level (regulation of blood glucose level and clinical aspects;

	glucosurira, hyper and hypoglycemia) **AII.3.13**define Glucose homeostasis (Regulation of blood glucose) Glycoproteins (structure, synthesis, degradation and biomedical and clinical importance)
AII.4	**A**II.4.1 Describe and differentiate between types of Diabetes millets **AII.4.2**Define diabetes mellitus and know its incidence, pathogenesis, metabolic changes, diagnosisand treatment of both types **AII.4.3**Explain Complications ofdiabetes mellitus (acute and chronic and its pathogenesis)
AII.5	**AII.5**.1Describe Lipogenesis (definition, site, regulation, steps) **AII.5**.2Discuss Fatty acid synthsis • Synthesis of saturated FA (Cytoplasmic FA synthesis, Mitochondrial FA synthesis, Microsomal FA synthesis) • Synthesis of unsaturated FA • Synthesis of glycerol and TG **AII.5**.3Describe and compare between different types of Fatty acid oxidation • B_oxidation , Alpha oxidation, Omega oxidation (definition, site, steps) • Oxidation of unsaturated FA **AII.5.4** Recognize Active acetate (sources and fate) **AII.5.5** Discuss Ketone bodies metabolism • Ketogenesis (definition, site, steps, biomedical importance and regulation) • Ketolysis (definition, site, steps, biomedical importance and regulation) • Ketosis (definition, pathogenesis, causes and effects) **AII.5.6** Describe Lipoprotein metabolism and differentiate between different types of lipoproteins • Definition, site, steps, biomedical importance, regulation and metabolism of each type • Apoproteins (definition, role and types) • Enzymes in lipid transport

	• Primary disorders of plasma lipoproteins. **AII.5.7** Discuss Eicosanoids metabolism (Definition, members, synthesis, biological actions, clinical aspects) **AII.5.8** Describe Cholesterol metabolism • Structure, Synthesis, Transport and Degradation • Blood cholesterol levels and its clinical aspects • Bile acids and bile salts (structure, synthesis and clinical aspects) • Steroid hormones (synthesis, secretion and mechanism of action) **AII.5.9** Recognize Phospholipid and glycosphingolipids metabolism • Structure , Function, Biosynthesis and catabolism of different types of PL • Types and synthesis of glycosphingolipidos • Sphingolipidosis **AII.5.10** Describe role of adipose tissue in lipid metabolism with stress on hormonal regulation **AII.5.11** Discuss Fatty liver (definition, causes ,pathogenesis and lipotropic factors)
AII.6	**AII.6-1**describe amino acid pool **AII.6-2** demonstrate catabolic pathways of amino acids (transamination-deamination-decarboxylation-transamidation) **AII.6-3** Describe sources & fates of ammonia **AII.6-4** Describe urea biosynthesis (steps-regulation-metabolic disorders) **AII.6-5** Describe the nitrogen balance **AII.6-6**recognize biosynthesis of non essential amino acids **AII.6-7** discribe catabolism of carbon skeleton of a.a. **AII.6-8** Describe conversion of amino acids to specialized product **AII.6-9** list nitrogen containg compound.
AII.7	**AII.7-1** Describe synthesis of purine nucleotide

	a-denovopathway (steps-regulation) b-salvage pathway c-deoxyribonucleotide synthesis(steps-regulation) **AII.7-2** discribe catabolism of purin nucleotides **AII.7-3** explain metabolic disorders of purine metabolism(hypouricemia-hyperuricemia) **AII.7-4** Describe pyrimidine synthesis &degradation a-denovopathway (steps-regulation) b-salvage pathway c-catabolism **AII.7-5** synthetics base analoges used in chemotherapy
AII.8	**AII.8-1** describe (structure-synthesis-regulation-disorders) of porphyrin
AII.9	**AII.9-1** Describe enzyme change in fed &fasting state **AII.9-2** discribe role of (liver-adipose tissue-muscle-brain)in fed &fasting state
AII.10	**AII.10.1** describe structure & funtion of plasma membrane **AII.10.2** Describe Artificial membrane **AII.10.3** explain transfer of material and information across membranes: • Transport processes • Transport proteins **AII.10.4** enumerate membrane Diseases
AII.11	**AII.11.1** Explain hormone synthesis, secretion and transport: • Steroid synthesis • Catecholamines synthesis • Thyroid synthesis • Hormone synthesis from larger peptide precursors
AII.12	**AII.12.1** Describe The Target Cell Concept **AII.12.2** Discuss Hormone Receptors(Definition/ nature/ characters/types)

	AII.12.3 Describe Classification of hormones: according to: • Chemical nature • Mechanism of Hormonal action
AII.13	**AII.13.1** enumerate immunoglobulins types,Functions ,structure& Diseases **AII.13.2**describe collagen Structure,types,biosynthesis&degradation **AII.13.3** explain elastin Structure, degradation &disorders of degradation **AII.13.4** understand Fibrillin& Marfan Syndrome **AII.13.5** discuss Fibronectin structure& Functions
AII.14	**AII.14**.1 Describe fat- soluble vitamins (active forms , synthesis ,function ,toxicity , deficiency) . **AII.14**.2 Describe water –soluble vitamins (chemistry ,function ,toxicity , deficiency & co-enzyme forms of each one of vitamin B complex members). **AII.14**.3 Describe absorption ,transport , storage , function ,toxicity & deficiency of macroelements & trace elements
AII.15	**AII.15.1 Discuss** mechanism of action of enzymes. **AII.15.1**a to identify characters and types of enzymes. **AII.15.1**b to compare different mechanisms to facilitate catalysis. **AII.15.2** Identify role of prosthetic groups, cofactors and co-enzymes and their types. **AII.15.3** identify isoenzymes **AII.15.4** explain how catalytic activity of enzymes facilitate their detection. **AII.15.5** demonstrate application of enzymes in diagnosis of diseases. **AII.15.6** illustrate role of recombinant DNA in studying enzymes. **AII.15.7** describe types of chemical reactions.& factors affecting the reaction rate **AII.15.8** recognize kinetics of enzymatic catalysis. **AII.15.8** a. Factors affecting the rate of enzyme-catalyzed reactions. **AII.15.8**b. To demonstrate effects of substrate concentration by Michaelis-Menten and Hill equation.

	AII.15.8 c To distinguish competitive and non competitive inhibition. **AII.15.9** define types of enzyme-catalyzed reactions. **AII.15.10** recognize role of enzymes in drug discovery. **AII.15. 11** Describe How to explain regulation of enzyme at both quantity & catalytic activity levels .
AII.16	**AII.16.1** Describe Important Proteins of Muscle **AII.16.2** Explain the sequence of Events in Contraction and Relaxation of Skeletal Muscle & Smooth Muscle **AII.16.3** Discuss Regulation of Muscle Contraction **AII.16.4** Describe Role of Ca2+ in Regulation of Muscle Contraction **AII.16.5** Describe Role of Sarcoplasmic Reticulum in Regulation of Intracellular Levels of Ca2+ in Skeletal Muscle **AII.16.6** describe Channelopathies& Inherited Cardiomyopathies **AII.16.7** Describe synthesis& Functions of Nitric Oxide **AII.16.8** enumerate Mechanisms Replenish Stores of ATP in Muscle **AII.16.9** Describe Types of Muscle Fibers and Major Fuel Sources Used by a Sprinter and by a Marathon Runner **AII.16.10** study of Cytoskeleton (Intermediate Filaments, Microfilaments & Microtubules).
AII.17	**AII.17**.1 Describe electron transport chain(def, components, enzyme complexes, sequence of events) **AII.17**.2 Describe oxidative phosphorylation (Definition, site , energetic, Theories, p/o ratio, Inhibitors& Uncouplers) **AII.17**.3 Differentiate between energy production in biological and non biological systems **AII.17**.4 Mention Genetic mitochondrial disorders **AII.17**.5 discuss oxidation of cytoplasmic NADH **AII.17**.6 Discuss and interpret bioenergetics (definition, first law of thermodynamics, gibbs free energy and standard free energy)

	AII.17.7 Recognize ATP (sources and biological importance) **AII.17**.8 Describe Low and high energy bonds **AII.17**.9 Describe the redox potential. **AII.17**.10 Discuss oxidoreductases
AII.18	**A34**.1Describe the two phases of Xenobiotics Metabolism **A34**.2 Discuss Isoforms of Cytochrome p450&their function **A34**.3 Enumerate Responses to Xenobiotics
AII.19	**AII.19**.1Describe sources& effects of free radicals **AII.19**.2 Explain protection against free radicals by Antioxidants
AII.20	**AII.20**.1 study Plasma Proteins & their Functions **AII.20**.2 discuss Iron metabolism (absorbtion and storage) **AII.20**.3 explain Copper metabolism (absorbtion and storage) **AII.20**.4 discuss the deficiency of alpha1-Antitrypsin as one of Plasma Proteins **AII.20**.5 Describe Amyloidosis **AII.20**.6 describe Hemostasis & Thrombosis (Phases, Types of Thrombi& Intrinsic & Extrinsic Pathways) **AII.20**.7 Describe the Functions of the Proteins Involved in Blood Coagulation. **AII.20**.8 enumerate Hereditary Bleeding Disorders **AII.20**.9 describe Activation of Platelets &role of Aspirin as an Antiplatelet Drug **AII.20**.10 discuss the regulation of Circulating Thrombin with stress on Antithrombin& Coumarin Anticoagulants **AII.20**.11 describe role of Plasmin in Hemostasis **AII.20**.12 explain the role of Endothelial Cells Hemostasis **AII.20**.13 enumerate Laboratory Tests Measure Coagulation, Thrombolysis, & Platelet Aggregation
AII.21	**AII.21**.1 Recognize molecular basis of protein synthesis and how to determine the expression of certain proteomics in diseased cell: **AII.21**.1.1 : Describe different features of genetic code **AII.21**.1.2 : Explain the three phases of protein synthesis: initiation with formation of initiation complex, elongation and termination. **AII.21**.1.3 : Understand regulation and control of protein synthesis • Explain control at the level of gene expression.

- Know regulation and control of initiation
- Understand how protein synthesis respond to environmental threats.
- Explain how viruses can affect protein synth.
- Recognize post translational processing affects the activity of synthesized protein.
- Describe the effect of Antibiotics on bacterial protein synth.

AII.21.2 know updates of the regulation of gene expression

AII.21.2.1 Classifying types of genes according to the mechanism of their expression.

AII.21.2.2 recognizing different types of regulation of gene expression in prokaryotes

- Recognizing catabolic regulation (lac operon)
- Explain co-repression (tryptophan operon)
- Demonstrate genetic switching (λ phage cycle)

AII.21.2.3 classifying the levels of euokaryotic regulation of gene expression.

- regulation of gene expression at the Genomic level (gene rearrangement &gene amplification)
- regulation 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.
- regulation of gene expression at Post transcriptional level (RNA processing, RNA stability, RNA editing & the effect of micro-RNA on mRNA)

Describe the basis of determining genes and methods of amplification of those genes.

AII.21.3 Describe Recombinant DNA technology

- Explain clearly what is cloning and its steps
- Understand 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
- Differentiate between in vivo & in vitro amplification(PCR) and explain applications of PCR.

AII.21.4 Describe genomic technologies :

- Compare between genomic and cDNA libraries.
- Understand different methods gene localization and gene sequencing .
- Know RNA and protein profiling and protein – DNA interaction mapping.

AII.21.5 Explain the role of gene therapy as a therapeutic indications of DNA technology :

	• Discuss types of diseases can be treated with gene therapy and types of vectors used. • Understand well gene therapy strategies
AII.22	**AII.22**.1 Define oncogenes&their role in cancer development **AII.22**.2 List tumor markers&their use in dignosis andfollow up of cancer
AII.23	**AII.23**.1 Understand the concept of stem cells and their importance. **AII.23**.2 Summarize the causes of the major disorders affecting red blood cells. **AII.23**.3 Discuss the general structure of the red blood cell membrane. **AII.23**.4 Know the biochemical bases of the ABO blood group substances. **AII.23**.5 Indicate the major biochemical features of neutrophils and understand the basis of chronic granulomatous disease. **AII.23**.6 Appreciate the importance of integrins in health and disease.

B-Intellectual skills:

BII.1	Interpret symptoms, signs and biochemical laboratory findings of some metabolic disorders.
BII.2	Point-out the etiology of metabolic disturbance in a given case study report.
BII.3	Point-out the application of molecular biology in basic and clinical sciences.
BII.4	Interpret symptoms, signs & biochemical laboratory findings of vitamins deficiency diseases
BII.5	Interpret the clinical significance of determination of plasma levels of glucose, total proteins, SGOT, SGPT, bilirubin, albumin, cholesterol, TG, creatinine and uric acid
BII.6	Diagnose the type of abnormality of pathological glucose tolerance curve

B- Professional/practical skills:

CII.1	Perform molecular biology techniques: PCR
CII.2	Perform hormonal analysis: pituitary, thyroid, pancreatic and sex hormones.
CII.3	Identify gene polymorphisms by restriction endonucleases

CII.4	Measure some parameters by ELISA

D- Communication & Transferable skills:

DII.1	To be able to work effectively in a group in lab or during preparation of seminars
DII.2	To respect the role of staff and co-staff members regardless of degree or occupation.
DII.3	To be able to use computer and IT.

(3) Course content: Total teaching hours : 195 hr (13 credit hr) ,practical 240 hr (8 credit hr)

A. lectures:

Subject	NO. of hours
Module 1	
1.Water metabolism & acid-base balance	10
2. Chemistry of carbohydrate, lipid & protein	20
3.Metabolism of Carbohydrate& glycoprotein.	20
4. Diabetes mellitus	5
5 Metabolism of lipid & ecosanoids	20
6.. Metabolismof protein & individual amino acids.	15
7. Purine & pyrimidine nucleotides metabolism	7
8. Porphyrine metabolism & bile pigment.	7
9.Metabolic integration& the Fed/Fast cycle.	3
10. Biological Transport and cell membrane	5
11. Biochemistry of endocrine glands.	10
12. Hormonal action & Cell signaling.	3
Module 2	
1. Molecular biology & biotechnology	26

2. Oncology (oncogenes & tumor markers).	5
3. Immunochemistry and tissue chemistry	2
4. Micronutrients (Vitamins & Minerals)	10
5. Enzymes	10
6. Muscle chemistry & metabolism	4
7. Biological oxidation & bioenergetics.	5
8. Xenobiotics and detoxification	2
9. Free radicals and antioxidants	2
10. Blood (plasma proteins & homeostasis).	4
Total teaching hours	195

B. Log book activities:

Subjects	NO. of hours
A. practical:	
1 DNA extraction and visualisation by agarose gel electrophoresis	22
2 Molecular biology techniques: PCR	22
3 Electrophoresis	20
4 Hormonal analysis: Pituitary Thyroid Pancreatic sex hormones	 6 6 7 7
5 Gene polymorphisms by restriction endonucleases	18
6 Measurement of some parameters by ELISA: HCV HBV Insulin	 15 15 15

H. pylori	15
7 Colorimetric estimation of :	
Glucose tolerance curve	7
Glycated hemoglobin	6
Albumin/globulin ratio	7
Serum bilirubin	7
Serum GPT (kinetic)	6
Serum GOT(kinetic)	6
Serum lactate dehydrogenase (kinetic)	6
Serum acid phosphatase	7
Serum HDL/LDL ratio	7
Serum TG	6
Creatinine clearance	7
Total log book activities	**8 credit hr practical =240 contact hrs**

(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

(4) Assessment methods:

5.1: MCQ Examination for assessment of knowledge and intellectual ILOs

5.2: Written Examination for assessment of knowledge and intellectual ILOs

5.3: Oral examinationfor assessment of ILOs number: knowledge and intellectual and transferable ILOs.

5.4: OSPE Practical examinationfor assessment of knowledge , intellectual , practical and transferable ILOs.

5.5: Log book for activities for assessment of : mainly for assessment of practical & transferrable skills which are accepted through attending different conferences, thesis discussions, seminars, workshops, attending scientific lectures as well as self learning.

5.6: The supervisor require certain lab tests or exam that are evaluated and signed by the supervisors in the log book (without marks).

5.7: seminars: the candidate should prepare and present at least one seminar in a topic related to the course and determined by the supervisors in front of the department staff (without marks).

Assessment schedule:

- After 36 month from job registration (written, oral and practical exam with marks).

Percentage of each Assessment to the total mark:

Tools	Marks	Percentage of the total mark
Advanced Medical Biochemistry & Molecular Biology (Basic level II)		
Written exam	300	46.3%
Oral exam	150	23%
Practical exam	150	23%

Other types of assessment

- Log book required activities to go through 2nd part examination .

Other assessment without marks:

- Practical tests and/or exam as well as the seminarthroughout the course and lab rotation (without marks).The candidate should prepare and present at least one seminar in atopic related to the course and determined by the supervisors in front of the department staff (without marks)

(5) References of the course:

6.1: Hand books:

- Medical biochemistry department (student book)

6.2: Text books:

- Harper's Illustrated Biochemistry: 28th edition by Murray RK, Granner DK, Mayes PA, Rodwell VW, McGraw-Hill companies New York, 2009.

- 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.
- 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
- 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, 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.

- 6.3: 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
- Laboratories: The Department has 3 laboratories for research with a wide range of instrumentation that is available for training and research .
  - library
  - Computer laboratories with a wide range of software
  - Intranet with a wide range of learning support material

Course coordinator: staff members of the credit

Head of the department:

Prof.Dr/FagrBazeed

Date: 1/11/2015