COURSE SPECIFICATION

Medical Biochemistry & Molecular Biology (Basic level I)

Faculty of Medicine- Mansoura University

(A) Administrative information

(1) Programme offering the course:	Master degree of Basic Medical Sciences in Biochemistry
(2) Department offering the programme:	Medical Biochemistry Department
(3) Department responsible for teaching the course:	Medical Biochemistry Department
(4) Part of the programme:	First 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 (Basic level I)
(8) Course code:	BIC 504
(9) Total teaching hours:	90 hr lectures 60 hr practical
(10) Total credit hours:	6 hours lectures 2 hr practical

(B) Professional information

(1) Course Aims:

Provide candidate with a basic knowledge in modern biochemistry and molecular biology necessary for an understanding of the life sciences at the molecular level in addition to a basic training in the principles of biochemistry and molecular biology techniques.

(2) Intended Learning Outcomes (ILOs):

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

A- Knowledge and Understanding

AI.1	**AI.1.1** define classification and strucrure of monosaccharides **AI.1.2** define derivatives of monosaccharides **AI.1.3** define disaccharides **AI.1.4** define polysaccharides(classification, homopolysaccharides, heteropolysaccharides “GAGs” **AI.1.5** Describe digestion, absorption of CHO and glucose uptake by tissues. **AI.1.6** Describe glycolysis (defination, site, function, steps, regulation and metabolic diseases) **AI.1.7** discuss gluconeogenesis (defination, site, importance, gluconeogenic substrates , steps, regulation) **AI.1.8** discuss glycogen metabolism - Glycogenesis - Glycogenolysis (definition, site and steps) - Regulation of glycogen metabolism - Glycogen storage disease **AI.1.9** Recognize oxidative decarboxylation of pyruvic acid **AI.1.10** Recognize citric acid cycle (definition, site, steps, biomedical importance, regulation and inhibitors, energetic, clinical aspects and role of vitamins) **AI.1.11** discuss hexose monophosphate shunt (definition, site, biomedical importance, function of NADP, regulation and clinical aspects) **AI.1.12** discuss uronic acid pathway (definition, site, importance, pathways of UDPG, biosynthesis of amino sugars) **AI.1.13** Recognize metabolism of other hexoses • Fructose metabolism(biomedical importance, conversion of fructose to glucose, conversion of glucose 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) **AI.1.14** define Glucose homeostasis (Regulation of blood glucose) **AI.1.15** discuss diabetes mellitus (def, types, metabolic changes, diagnosis and complication)
AI.2	**AI.2.1** Recognize strucure, importance and classification of lipids

	AI.2.2 Discuss structure and function of phospholipids, glycolipids , sulpholipids and lipoproteins **AI.2.3** Define structure and function of derived lipids **AI.2.4** recognize chemistry and function of carotenes **AI.2.5**Describe Lipogenesis(definition, site, regulation, steps) **AI.2.6** Discuss Fatty acid synthsis • Synthesis of glycerol and TG • Synthesis of saturated FA (Cytoplasmic FA synthesis, Mitochondrial FA synthesis, Microsomal FA synthesis) • Synthesis of unsaturated FA **AI.2.7**Describe Lipoprotein metabolism • 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 **AI.2.8** Recognize Fatty acid oxidation • Recognize B_oxidation , Alpha oxidation, Omega oxidation (definition, site, steps) • Recognize Oxidation of unsaturated FA **AI.2.9** Recognize Active acetate (sources and fate) **AI.2.10**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) **AI.2.11** Discuss Eicosanoids metabolism(Definition, members, synthesis, biological actions, clinical aspects) **AI.2.12** 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) **AI.2.13** Recognize Phospholipid metabolism (Structure , Function, Biosynthesis and

	catabolism of different types of PL). **AI.2.14**Describe role of adipose tissue in lipid metabolism with stress on hormonal regulation **AI.2.15** Discuss Fatty liver (definition, causes ,pathogenesis and lipotropic factors)
AI.3	**AI. 3.1** Describe types of chemical bonds **AI.3.2** Recognize types of chemical reactions **AI.3.3** Define acid and alkalis **AI.3.4** Recognize PH (def, values and measuement) **AI.3.5** Discuss buffers (def, forms, mechanism of action types of blood buffers and clinical significance) **AI.3.6** Discuss solution (def, classification) **AI.3.7** define colloids, viscosity, dialysis, osmosis
AI.4	**AI.4.1** Understanding importance , classification , general properties of protein **AI.4.2** Recognize Structure, classification , properties of amino acids **AI.4.3** Recognize protein strucure, protein folding and protein misfolding **AI.4.4** Describe amino acid pool **AI.4.5** demonstrate catabolic pathways of amino acids (transamination-deamination-decarboxylation-transamidation) **AI.4.6** Recognize sources & fates of ammonia **AI.4.7** Recognize urea biosynthesis (steps-regulation-metabolic disorders) **AI.4.8** Recognize the nitrogen balance **AI.4.9** recognize biosynthesis of non essential amino acids **AI.4.10** describe catabolism of carbon skeleton of a.a.
AI.5	**AI.5.1** describe structure, nutritional value, biosynthesis metabolic fate and catabolic pathway of non essential amino acid **A5.2** describe structure, nutritional value, metabolic fate and metabolic pathway of essential amino acid
AI.6	**AI.6.1** Explain synthesis of porphyrins and heam (site, steps,regulation and metabolic defects) **AI.6.2** discuss porphyria (def, types, causes and manifestation) **AI.6.3** recognizeheam catabolism **AI.6.4** explain and compare between types of hyperbillirubinemia =jaundice **AI.6.5** Define types, structure, derivatives and fate of heamoglobin
AI.7	**AI.7.1** Recognize strucure, derivatives and importance of nucleotides **AI.7.2** describe free nucleotides of biological importance **AI.7.3** define mitochonderial DNA **AI.7.4** Describe structure of DNA (1ry- 2ry- tertiary- DNA supercoiling) **AI.7.5** Describe types and structure of RNA **AI.7.6** Recognize synthesis of purine nucleotide (denovopathway steps-regulation) **AI.7.7** describe catabolism of purine nucleotides **AI.7.8** explain metabolic disorders of purine metabolism(hypouricemia-hyperuricemia)

	AI.7.9 Recognize pyrimidine synthesis &degradation(denovopathway -steps-regulation) **AI.7.10** memorizes synthetics base analoges used in chemotherapy.
AI.8	**AI.8.1** Recognize enzyme change in fed &fasting state **AI.8.2** describe role of (liver-adipose tissue-muscle-brain)in fed &fasting state **AI.8.3** Recognize absorption ,transport , storage , function ,toxicity & deficiency of maroelements& trace elements .
AI.9	**AI.9.1** Recognize Hormone Receptors (Definition/ nature/ characters/types) **AI.9.2** Recognize Classification of hormones **AI.9.3** Recognize Mechanism of action of hormones that bind to intracellular receptors **AI.9.4** Describe Mechanism of action of hormones that bind to cell surface receptors **AI.9.5** Explain Hormones that act through cAMP **AI.9.6** Explain Hormones that act through cGMP **AI.9.7** Describe Hormones that act through a kinase or phosphatase cascade (Intrinsic protein tyrosine kinase activities - Associated protein tyrosine kinase activities)
AI.10	**AI.10.1** Explain electron transport chain(def, components, enzyme complexes, sequence of events) **AI.10.2** Explain oxidative phosphorylation (def, sites, mechanism, inhibitors, energetic, p/o ratio and uncoupler) **AI.10.3** Identify genetic mitochondrial disorders **AI.10.4** Define oxidation of cytoplasmic NADH+H+ **AI.10.5** Define bioenergetics (definition, first law of thermodynamics, gibbs free energy and standard free energy) **AI.10.6** Recognize ATP (sources and biological importance) **AI.10.7** Describe Low and high energy bonds
AI.11	Definition, importance, phases of metabolism, toxic effect of xenobioteics
AI.12	**AI.12.1** define chemistry, sources, Structure, function deficiency of water soluble vitamins **AI.12.2** define chemistry, sources, Structure, function deficiency of fat soluble vitamins
AI.13	**AI.13.1** Define chemical nature and classification of enzymes **AI.13.2** Discuss oxidoreductases **AI.13.3** Define Mechanism of action of enzymes. **AI.13.4** Discuss factors affecting rate of enzyme action **AI.13.5** Explain enzyme specificity **AI.13.6** Describe Enzyme inhibition **AI.13.7** Define Enzyme units **AI.13.8** Discuss regulation of enzyme activity **AI.13.9** Define isoenzymes **AI.13.10** Discuss coenzymes
AI.14	**AI.14.1** Describe DNA organization • Explain structure of chromatin and chromosomes • Describe Levels of DNA packing (nucleosomes- higher level of organization) **AI.14.2** Define genetic terminology (gene- genome) **AI.14.3** Describe human genome project (HGP) **AI.14.4** Describe DNA replication (steps , types and character of DNA polymerases,

	AI.14.5 Recognize Types and functions of proteins responsible for DNA replication **AI.14.6** Define replisome and primosome **AI.14.7** Discuss post replication modification of DNA **AI.14.8** Study mutation (def, effect, causes, classification, clinical application) **AI.14.9** Study heamoglobinopathies (normal heamoglobin, sickle cell disease, thalassemia) **AI.14.10** Discuss DNA repair (mismatch repair- base excision repair- nucleotide excision repair) **AI.14.11** Recognize transcription (required materials- transcription unit structure, steps, post transcription modification and antibiotic inhibitors) **AI.14.12** post transcription modification (mRNA- tRNA- rRNA) **AI.14.13** define RNA polymerase enzyme, Reverse transcriptase **AI.14.14** Describe telomeres and telomerase **AI.14.15** Discuss genetic code and characteristics of genetic codons **AI.14.16** Discuss protein synthesis (steps, requirements steps- post translation modification and inhibitors of protein synthesis) **AI.14.17** Describe post translation modification **AI.14.18** Discuss regulation of gene expression • At the level of gene • At the level of transcription • At the level of RNA • At the level of translation **AI.14.19** Discuss Recombinant DNA technology= genetic engenering(mechanism, practical application) **AI.14. 20** Define vectors **AI.14.21** Describe DNA amplification techniques • DNA cloning • Polymerase chain reaction AI.14.22 Describe molecular analysis of diseases AI.14.23 Describe techniques in molecular biology • DNA sequencing • Blotting techniques • DNA microarray (DNA chips)

	AI.14.24 Discuss biochemistry of cancer (carcinogenesis)
AI.15	**AI.15.1** Discuss functions of major intracellular organelles (Nuclues- mitochonderia- cytosol- lysosome- peroxisome- golgi apparatus- endoplasmic reticulum) **AI.15.2** Explain Strucue of biological membrane (plasma membrane – RBCs membrane)
AI.16	**AI.16.1** Discuss apoptosis (def,mechanism and importance) **AI.16.2** Define cell cycle (phases, control, cell cycle checkpoints and restriction point0

B- Intellectual skills

BI.1	Point-out the application of molecular biology in basic and clinical sciences.
BI.2	Interpret symptoms, signs and biochemical laboratory findings of vitamins deficiency diseases
BI.3	Interpret the clinical significance of determination of plasma levels of glucose, total proteins, SGOT, SGPT, bilirubin, albumin, cholesterol, TG, creatinine and uric acid
BI.4	Diagnose the type of abnormality of pathological glucose tolerance curve

C-Professional/practical skills

CI.1	Identify laboratory reagents and instruments used in biochemistry laboratory
CI.2	Perform manual and automatic colorimetric estimation of some blood parametars (serum levels of glucose, total proteins, albumin, bilirubin, GPT, GOT, alkaline phosphatase, cholesterol, TG, creatinine and uric acid).
CI.3	Perform urine analysis (Identify the physiological variations of physical and chemical characters of normal urine and performing chemical tests to detect abnormal constituents of urine).
CI.4	Perform chemical DNA extraction.
CI.5	Perform agarose gel electrophoresis .
CI.6	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.
CI.7	Perform different aspects of the physical chemistry

D-Communication & Transferable skills

DI.1	To be able to work effectively in a group in lab or during preparation of seminars
DI.2	To respect the role of staff and co-staff members regardless of degree or occupation.
DI.3	To be able to use computer and IT.
DI.4	To be able to search in database

(3)Course content:

A. lectures:

Subjects	NO. of hours
Module 1	
1.Carbohydrate chemistry	**4**
2. Lipid chemistry	**5**
3. Protein chemistry	**3**
4. Purine & pyrimidine chemistry & metabolism	**5**
5. Physical chemistry	**3**
6. Molecular biology & recombinant DNA	**15**
7. Vitamins& enzymes	**6**
8. Basic knowledge of Cell cycle & apoptosis.	**3**
Module 2	
1.Carbohydrate metabolism**.**	**10**
2. Lipid metabolism	**10**
3. General protein metabolism	**4**
4 Individual amino acid Metabolism	**6**
5. Principles of Heme metabolism	**2**
6. Metabolic interrelation & minerals	**4**
7. Mechanism of hormonal action	**4**
8.Basic function of Cell organelles & structure of biological membrane	**2**
9. Biological oxidation &Xenobiotic metabolism	**4**

Total teaching hours	90

B. Log book activities:

Subjects	NO. of hours
A. practical:	
1 Identificaion of laboratory reagents and instruments. Guidelines of work in research lab. safety& ethical code. Methods of searching in database & information technology.	**4**
2 Colorimetric estimation (manual and automatic) of : Serum glucose level Serum total proteins level Serum albumin level Serum bilirubin level Serum GPT level Serum GOT level Serum alkaline phosphatase level Serum cholesterol level Serum TG level Serum creatinine level Serum uric acid level	 **3** **3** **3** **3** **3** **3** **3** **3** **3** **3** **3**
3 Urine analysis	**5**
4 Chemical DNA extraction	**5**
5 Agarose gel electrophoresis	**4**
6 Estimation of the risks of handling and use of che agents on community and environment	**4**
7 Physical chemistry	**5**
Total teaching hours	**2 credit hr practical =60 contact hrs**

(3) 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: Structured Oral examination for assessment of 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 12 month from MR registration (written, oral and practical exam with marks)

Percentage of each Assessment to the total mark:

Tools	Marks	Percentage of the total mark
Medical Biochemistry & Molecular Biology (Basic level I)		
Written exam	144	40%
MCQ exam	36	10%
Oral exam	60	16.6%
Practical exam	60	16.6%

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 seminar throughout 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: 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.
- 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
- 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.

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 credit committee of the department

Head of the department:

Prof. / Ayman El-Baz

Date: 29/4/2018