141 MBC (Medical Biochemistry –1)

<table>
<thead>
<tr>
<th>Course name</th>
<th>Medical Biochemistry -1</th>
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<tbody>
<tr>
<td>Course code &amp;No.</td>
<td>MBC 141</td>
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<tr>
<td>Credit hours</td>
<td>8 hours</td>
</tr>
<tr>
<td>Duration</td>
<td>One academic year</td>
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<tr>
<td>Study year</td>
<td>First year of Medical college</td>
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Lectures: 3 /week = 3 h  
Tutorials: once/week = 3 h  
Practical: once/week = 3 h

The course is conducted to two male student groups (A&B) and one female student group.

1. Course objectives:

1. To provide an introduction to the principles of biochemistry that gives the students a command of its concepts.

2. To provide an explanation of the relationship between the three-dimensional structure of macromolecules and their biological activities.

3. To give the students insight into appreciating how understanding of metabolic processes occurring in the mammalian body, could contribute to the understanding and explanation of pathological phenomena.

4. To make the students familiar with the various control and integrating mechanisms of diverse biochemical events in different metabolic processes, and to understand normal and abnormal human metabolism.

5. To give the students experience in biochemical methodology in order to appreciate the clinical biochemistry techniques as diagnostic tools and to be able to interpret the results for appropriate diagnosis and follow up of patients.

2. Practical / Tutorial:

For practical, each main group (A&B) will be subdivided into 3 sub-groups to allow a relatively small group at each practical class. A practical handout will be given to the student at the beginning of the year including all the practical classes to be given. It is beneficial for the student to read and understand the theoretical background of the class before coming to the laboratory. Every practical class includes a MCQ test on the theoretical background covered in the practical. A report about the wet
practical must be handed in for marking at the completion of the practical class.

**For tutorial**: Discussion in a relatively small groups including questions and answers together with a problem based learning (PBL) is actively encouraged during these tutorials.

3. **Academic Supervisor**: The students will be supervised by the teaching staff members to advise them on the academic and other problems. Office hours are assigned for the staff to meet with the students for this purpose.

4. **Attendance**: attendance of the student will be registered at every lecture, practical and tutorial. According to the University regulations, the student will not be allowed to sit in the final examination at the end of the year if his attendance is less than 75%.

5. **Tutorial Quiz**: There will be two announced tutorials (MCQ tests) each term.

6. **Continuous Assessment**: Two announced tests (Midterm) & a midyear examination will be on all course material completed to-date. The examinations are designed to give the student the opportunity to see what can he accomplish and to let us know if the teaching achieved the required results.

6. **Final Examination**: At the end of the first year, the student will sit for a final examination that include only a written examination (MCQ) for which 40 marks will be assigned.
141 MBC : Course Outline:

**PROTEIN STRUCTURE AND FUNCTION :**

**Amino Acids**  
- Structure of the amino acids  
- Acidic and basic properties of A.A.

**Structure of Proteins**  
- Primary structure of proteins  
- Secondary structure of proteins  
- Tertiary structure of globular proteins  
- Quaternary structure of proteins  
- Denaturation of proteins  
- Protein misfolding

**Fibrous proteins**  
- Collagen  
- Elastin

**Enzymes**  
- Nomenclature  
- Properties of enzymes  
- Factors affecting reaction velocity  
- Michaelis – Menten equation  
- Inhibition of enzyme activity  
- Regulation of enzyme activity  
- Enzymes in clinical diagnosis

**INTERMEDIARY METABOLISM :**

**Bioenergetics and Oxidative Phosphorylation**  
- Free energy  
- ATP as an energy carrier  
- Electron transport chain  
- Oxidative phosphorylation

**Introduction to Carbohydrates**  
- (4 lectures)
- Classification and structure of carbohydrates
- Isomers and epimers
- Enantiomers
- Cyclization of monosaccharides
- Complex carbohydrates
- Digestion of carbohydrates

Carbohydrates metabolism  (3 lectures)
- Introduction to metabolism
- Regulation of metabolism
- Overview of glycolysis
- Transport of glucose into cells
- Reactions of glycolysis
- Hormonal regulation of glycolysis
- Alternate fates of pyruvate

Tricarboxylic Acid Cycle  (2 lectures)
- Oxidative decarboxylation of pyruvate
- Reactions of the TCA cycle
- Energy produced by the TCA cycle
- Regulation of the TCA cycle

Gluconeogenesis  (2 lectures)
- Substrates for gluconeogenesis
- Reactions unique to gluconeogenesis
- Regulation of gluconeogenesis

Glycogen metabolism  (3 lectures)
- Structure and function of glycogen
- Synthesis of glycogen (Glycogenesis)
- Degradation of glycogen (Glycogenolysis)
- Regulation of glycogen synthesis and degradation
- Glycogen storage diseases

Metabolism of Monosaccharides and Disaccharides  (2 lectures)
- Fructose metabolism
- Galactose metabolism
- Lactose synthesis

Pentose Phosphate Pathway and NADPH  (3 lectures)
- Irreversible oxidative reactions
- Uses of NADPH
- G6PD deficiency

Glycosaminoglycans and Glycoproteins  (2 lectures)
- Overview of Glycosaminoglycans
- Structure of Glycosaminoglycans
- Classification of glycosaminoglycans
- Structure of proteoglycans
- Overview of Glycoproteins

Revision

LIPID METABOLISM:

Metabolism of Dietary Lipids
- Digestion of Dietary Lipids
- Absorption of Dietary Lipids
- Secretion and Utilization of Dietary Lipids

Fatty Acids and Triacylglycerol Metabolism
- Structure of fatty acids
- Saturation of fatty acids
- Essential fatty acids
- De Novo synthesis of fatty acids
- Storage of fatty acids as components of triacylglycerol
- Mobilization of stored fats and oxidation of fatty acids
- Release of fatty acids from TAG
- β-Oxidation of fatty acids
- α-Oxidation of fatty acids
- Ketone bodies

Complex Lipid Metabolism
- Overview of phospholipids
- Structure of phospholipids
- Phospholipid synthesis
- Glycerophospholipids
- Sphingophospholipids: Sphingomyelin
- Degradation of phospholipids
- Overview of Glycolipids
- Structure of glycosphingolipids
- Synthesis and degradation of glycosphingolipids
- Prostaglandins and related compounds

Cholesterol and Steroid Metabolism
- Overview of Cholesterol
- Structure of cholesterol
- Synthesis of cholesterol
- Degradation of cholesterol
- Bile acids and bile salts
- Plasma Lipoproteins
- Metabolism of VLDL
- Metabolism of LDL
- Metabolism of HDL
- Steroid hormones

NITROGEN METABOLISM:

**Amino Acids : Disposal of Nitrogen**
- Overall nitrogen metabolism
- Digestion of dietary proteins
- Absorption of A.A. and dipeptides
- Transport of A.A. into cells
- Removal of nitrogen from A.A.
- Urea Cycle
- Metabolism of ammonia

**Amino Acid Degradation and Synthesis**
- Glucogenic and ketogenic A.A
- Catabolism of the carbon skeletons of AA
- Biosynthesis of nonessential A.A.
- Metabolic defects in A.A. metabolism
- Phenylketonuria (PKU)
- Maple syrup urine disease
- Albinism
- Homocystinuria
- Alkaptonuria

**Conversion of A.A. to specialized products**
- Porphyrin metabolism
- Structure of porphyrins
- Biosynthesis of heme
- Porphyrias
- Other nitrogen-containing compounds

INTEGRATION OF METABOLISM
Metabolic effects of insulin and glucagons (3 lectures)
- Insulin
- Structure of insulin
- Synthesis of insulin
- Regulation of insulin secretion
- Metabolic effects of insulin
- Mechanism of insulin action
- Glucagon
- Metabolic effects of glucagon
- Mechanism of action of glucagon
- Hypoglycemia
- Types of hypoglycemia

The Feed / Fast Cycle (3 lectures)
- Enzymic changes in the fed state
- Liver: nutrient distribution center
- Adipose tissue: energy storage depot
- Resting skeletal muscle
- Brain
- Overview of fasting
- Liver in fasting
- Adipose tissue in fasting
- Resting skeletal muscle in fasting
- Brain in fasting

Water –Soluble Vitamins (3 lectures)
- Folic acid
- Cobalamin (vit B12)
- Ascorbic acid (vit C)
- Pyridoxine (vit B6)
- Thiamine (vit B1)
- Niacin
- Riboflavin (vit B2)
- Biotin
- Pantothenic acid

(B) Tutorials:
- Protein chemistry:
  - Amphoteric properties of A.A.
  - Orders of protein structure
  - Fibrous protein & clinical aspects
- Enzymology:
  - Enzyme Inhibition
- Regulation of enzyme activity
- Enzymes of clinical importance
- Shuttle mechanisms

- Carbohydrate Metabolism :
  - Glycolysis, Krebs& gluconeogenesis
  - Glycogen metabolism & HMP
  - Mono- & disaccharides metabolism

- Lipid metabolism :
  - Fatty acids & phospholipids
  - Glycolipids, Prostaglandins & Cholesterol

- Plasma Lipoproteins :
  - Diabetes mellitus

- Nitrogen metabolism :
  - Urea cycle
  - A.A. metabolism & clinical importance

(C) Practical:

1. Laboratory orientation, instrumentation, solutions and units
2. Qualitative tests for protein.
3. Quality control
4. α-Amylase and pancreatic functions
5. Plasma glucose estimation.
7. Vitamin C estimation in urine
8. Phenylketonuria.

DISTRIBUTION OF MARKS IN THE ANNUAL SYSTEM

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<th>Activity</th>
<th>Marks</th>
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<td>Practical &amp; tutorial</td>
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<td>First Assessment Test (Mid-term)</td>
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<td>Tutorial (quizzes)(2)</td>
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<th>FINAL Examination: (MCQ)</th>
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<tr>
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<td><strong>40 Marks</strong></td>
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**Assigned Textbook:**

**Additional Textbooks:**

**Internet sites:**
Medical Biochemistry Resources