APRIL 2001

[KD 876] Sub. Code : 5017

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Answer ALL questions.

1. Describe how blood glucose level is maintained. Mention its hormonal control. (25)

2. Write the sources, chemistry, requirements, functions and deficiency manifestations of vitamin D. (25)

3. Write short notes on : (5 × 10 = 50)

(a) Transamination.

(b) Phospholipids.

(c) Prostaglandins.

(d) Metabolism of Phosphorous.

(e) Electrophoresis.

DECEMBER 2001

[KE 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIO-CHEMISTRY — I

Time : Three hours Maximum : 100 marks

Answer ALL questions.

1. Draw and explain the Embden–Meyerhof path way. Mention about the energy production. (25)

2. Describe the source, daily requirement, chemistry, biochemical functions and deficiency manifestations of ascorbic acid in the body. (25)

3. Write short notes on : (5 × 10 = 50)

   (a) Lipoproteins

   (b) Urea cycle

   (c) Gluconeogenesis

   (d) Glycogen storage diseases

   (e) Biochemical role of Thyroid hormones.

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SEPTEMBER 2002

[KH 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Answer ALL questions.

1. Enumerate the factors that influence the absorption of calcium. What is the normal serum calcium level and write briefly about how its level in serum is regulated. (25)

2. Describe the formation of urea in the body. What is the normal blood urea level and describe in brief how it is estimated. (25)

3. Write short notes on : (5 × 10 = 50)

   (a) Fatty liver

   (b) Gluconeogenesis

   (c) Ascorbic acid

   (d) Biosynthesis of thyroid hormones

   (e) Pepsin.

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SEPTEMBER 2002

[KH 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Answer ALL questions.

1. What is Glycolysis? Discuss the reactions of Glycolysis. (25)

2. Discuss the metabolism of phenyl alanine and Tyrosine. Add a note on inborn errors. (25)

3. Write short notes on : (5 × 10 = 50)

   (a) Cholesterol biosynthesis

   (b) Lipoproteins

   (c) Deficiency manifestations of Vitamin A

   (d) Electrophoresis

   (e) Iron metabolism.

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APRIL 2003

[KI 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Answer ALL questions.

1. Name the water soluble vitamins. Describe the source, daily requirement, functions and deficiency manifestations of vitamin C. (25)

2. Name the various pathways for glucose metabolism. Write in detail about the tricarboxylic acid cycle and mention its metabolic importance. (25)

3. Write short notes on : (5 × 10 = 50)

   (a) Pancreatic Lipase.

   (b) Bile salts.

   (c) Phenyl ketonuria.

   (d) Absorption of Iron.

   (e) Role of insulin in carbohydrate metabolism.

AUGUST 2004

[KL 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Sec. A & B : Two hours and forty minutes Sec. A & B : 80 marks

Sec. C : Twenty minutes Sec. C : 20 marks

Answer ALL questions.

SECTION A — (2 × 15 = 30 marks)

1. Describe the formation and breakdown of glycogen. Write a note about glycogen storage diseases. (15)

2. Classify vitamins. Write a note on coenzymes. Describe in detail about the sources, daily requirement, functions and deficiency of Vitamin D. (15)

SECTION B — (10 × 5 = 50 marks)

3. Write short notes on :

(a) Glucagan

(b) Ascorbic acid

(c) Alkaptanuria

(d) Rickets

(e) Absortion of lipid

(f) Wald's visual cycle

(g) Lipoprotein

(h) Serum electrolytes

(i) 2-3 bisphosphoglycerate

(j) Pyridoxine.

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FEBRUARY 2005

[KM 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Sec. A & B : Two hours and forty minutes Sec. A & B : 80 marks

Sec. C : Twenty minutes Sec. C : 20 marks

Answer Sections A and B in the **SAME** answer book.

Answer Section C in the answer sheet provided.

Answer ALL questions.

SECTION A — (2 × 15 = 30 marks)

1. Name the Aromatic aminoacids. Discuss the metabolism of phenyl alanine. (15)

2. Give an account of B.oxidation of fatty acids with energetics. (15)

SECTION B — (10 × 5 = 50 marks)

3. Write short notes on :

(a) Phospholipids

(b) Irreversible steps in glycolysis

(c) Sulphur containing aminoacids

(d) Insulin

(e) HDL cholesterol

(f) Lipotropic factors

(g) Transferrin

(h) Functions of vitamin A

(i) Trace elements

(j) Phenyl ketonuria.

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AUGUST 2005

[KN 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Sec. A & B : Two hours and forty minutes Sec. A & B : 80 marks

Sec. C : Twenty minutes Sec. C : 20 marks

Answer Sections A and B in the **SAME** answer book.

Answer Section C in the answer sheet provided.

Answer ALL questions.

SECTION A — (2 × 15 = 30 marks)

1. Name the Fat Soluble vitamins. Describe the source, daily requirement functions and deficiency manifestations of Vitamin D.

2. How ammonia is detoxified in the body? Describe urea cycle in detail and mention the various hyperammonemia.

SECTION B — (10 × 5 = 50 marks)

3. Short notes :

(a) Paper Electrophoresis

(b) Biotin

(c) Digestion and Absorption of lipids in brief

(d) Different methods for the estimation of Ketone bodies in the urine

(e) Role of iron

(f) Wilson's disease

(g) Tyrosine

(h) Thiamine

(i) 1–25–Dihydroxy cholecalciferol

(j) Transamination.

MARCH 2006

[KO 876] Sub. Code : 5017

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Sec. A & B : Two hours and forty minutes Sec. A & B : 80 marks

Sec. C : Twenty minutes Sec. C : 20 marks

Answer Sections A and B in the **SAME** answer book.

Answer Section C in the answer sheet provided.

Answer ALL questions.

SECTION A — (2 × 15 = 30 marks)

1. Discuss Urea Cycle. What is the normal Blood urea concentration and mention is importance. (15)

2. Describe Hexose monophosphate shunt pathway. What is the significance? (15)

SECTION B — (10 × 5 = 50 marks)

3. Write short notes on the following :

(a) Galactosemia

(b) Mucopolysaccharides

(c) Serum Calcium

(d) Alkaptonuria

(e) Essential Amino acids

(f) Thyroid hormones

(g) Regulation of Blood sugar

(h) Serum Electrolytes

(i) Function of Vitamin C

(j) Lipoproteins.

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AUGUST 2006

[KP 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Descriptive : Two hours and forty minutes Descriptive : 80 marks

Objective : Twenty minutes Objective : 20 marks

Answer ALL questions.

1. Classify Diabetic Mellitus. Describe in detail about the regulation of blood glucose? Add a note on Glucose Tolerance Test. (20)

2. Define Vitamins. Classify Vitamins write in detail about a vitamin that causes neurological disorder. (15)

3. What is normal serum calcium level? Write in detail about the sources, daily requirement and calcium homeostasis. (15)

4. Write short notes on : (6 × 5 = 30)

(a) Buffers

(b) Iso Enzyme

(c) Role of thyroid hormone

(d) Alcaptanuria

(e) Lipo proteins

(f) Types of oxidation of fatty acids.

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AUGUST 2007

[KR 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Time : Three hours Maximum : 100 marks

Descriptive : Two hours and forty minutes Descriptive : 80 marks

Objective : Twenty minutes Objective : 20 marks

Answer ALL questions.

I. Essay : (2 × 15 = 30)

1. Describe the gluconeogenic pathway and regulation of blood glucose. (15)

2. What are the aromatic amino acids? Discuss the metabolism of Tyrosine. (15)

II. Write Short notes on : (10 × 5 = 50)

(a) Chylomicrons.

(b) Glycerophospholipids.

(c) Growth hormone.

(d) Essential aminoacids.

(e) Calcium and phosphorous.

(f) Cholesterol.

(g) Phenyl ketonuria.

(h) absorption of lipids.

(i) Pyridoxal phosphate.

(j) Specialized products of tryptophan.

FEBRUARY 2008

[KS 876] **Sub. Code : 5017**

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Q.P. Code : 725017

Time : Three hours Maximum : 100 marks

Descriptive : Two hours and forty minutes Descriptive : 80 marks

Objective : Twenty minutes Objective : 20 marks

Answer ALL questions.

1. Write about the synthesis of cholesterol in the body. Add a note on the fate of cholesterol in the body. (15)

2. How Urea is synthesized? Add a note on errors of urea synthesis. (15)

3. Write short notes on: (10 ×5 = 50)

(a) Role of insulin in carbohydrate metabolism.

(b) Role of vitamin K in coagulation.

(c) Von Gierke's disease.

(d) Iodine

(e) Biosynthesis of epinephrine.

(f) Transamination reactions.

(g) Calcitriol

(h) Antioxidant vitamins.

(i) Essential amino acids.

(j) Ketone bodies.

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August-2008

[KT 876] **Sub. Code : 5017**

B.Sc. (Medical laboratory Technology) DEGREE EXAMINATION.

Second Year

Paper II — BIOCHEMISTRY — I

Q.P. Code : 725017

Time : Three hours Maximum : 100 marks

Answer ALL questions.

I. Essays : (2 × 15 = 30)

1. Classify amino acids. Describe the metabolism of phenylalanine and defects associated with it.

2. Classify Diabetes Mellitus. Describe in detail about the regulation of blood glucose.

II. Write short notes on : (10 × 5 = 50)

1. Importance of HMP pathway

2. Lipid profile

3. Vanden berg reaction

4. Carnitine

5. Iron absorption

6. Niacin

7. Transamination

8. Van Gierke's disease

9. Specialised products from tryptophan

10. Substrate level phosphorylation

III. Short answer questions : (10 × 2 = 20)

1. What is the key enzyme for glycogenesis and glycogenolysis?

2. Name four glycogen storage diseases.

3. Name the disorders of urea cycle.

4. Name the aromatic aminoacids.

5. What are the methods of separation of lipoprotein?

6. What is Refsum's disease?

7. Name one vitamin which is synthesised from an amino acid.

8. What is the normal fasting and post prandial blood sugar level?

9. What is Wilson's disease?

10. What are the key gluconeogenic enzymes?

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August - 2009

[KV 876] Sub. Code: 5017

B.Sc. (Medical Laboratory Technology) DEGREE EXAMINATION

SECOND YEAR
Paper II – BIOCHEMISTRY-I

Q.P. Code : 725017

Time : Three hours **Maximum : 100 marks**

Answer All questions.

I. Essays : **(2X15=30)**

1. Write the sources of calcium, normal serum calcium level. How is the calcium level regulated? What are the biochemical functions of calcium? **(1+1+8+5)**
2. What are the steps to synthesize 1 mol of urea? How it is regulated? What is the normal level? **(10+4+1)**

II. Write Short Notes on : **(10X5=50)**

1. Glutathione.
2. Phospholipids.
3. Significance of pentose phosphate pathway.
4. Pancreatic hormones.
5. Homocystinuria.
6. Pyridoxal phosphate (PLP).
7. Sucrose.
8. Albumin.
9. Lactose Intolerance.
10. Oxidation of fatty Acids.

III. Short Answer Questions: **(10X2=20)**

1. Name the essential amino acids.
2. What are mucopolysaccharides? Give examples.
3. What are the key enzymes of gluconeogenesis?
4. Folate trap.
5. What are the coenzymes of cobalamin?
6. Name the antiatherogenic cholesterol. What is the normal level?
7. Name the Bile acids and Bile salts.
8. Name the enzymes whose deficiency causes galactosemia.
9. What is the importance of phosphatidic acid?
10. Name the catacolamines. Mention their precursor amino acids.

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[KW 876] **FEBRUARY 2010** **Sub. Code: 5017**

B.Sc. (MEDICAL LABORATORY TECHNOLOGY) DEGREE EXAMINATION

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

I. Elaborate on: **(2 x 15 = 30)**

1. Write the sources, daily requirement, biochemical functions and deficiency manifestations of Vitamin C. **(2+1+6+6)**
2. Explain in detail the regulation of blood glucose. Write briefly on oral glucose tolerance test. **(10+5)**

II. Write Short Notes on : **(10 x 5 = 50)**

1. Glycogen storage disorders.
2. Biologically important compounds synthesized from cholesterol.
3. Renal glycosuria.
4. Calcitriol.
5. Alkaptonuria.
6. Beta oxidation of fatty acids.
7. Energetics in the complete oxidation of glucose to carbondioxide and water.
8. Bio chemical functions of calcium.
9. Functions of Albumin.
10. Lipo proteins.

III. Short Answer Questions: **(10 x 2 = 20)**

1. Name two reducing disaccharides.
2. Rate limiting enzyme in cholesterol biosynthesis.
3. Name the essential fatty acids.
4. Normal serum level of calcium and phosphorus.
5. Name the plasma enzymes used to diagnose myocardial infarction.
6. Co enzyme forms of thiamine and riboflavin.
7. Mention two deficiency manifestations of vitamin D.
8. Apoproteins present in LDL and HDL.
9. What are Bence- Jones proteins? In which disease this is excreted.
10. Beer – Lambert's Law.

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[KX 871] **AUGUST 2010** **Sub. Code: 5017**

B.Sc. (MEDICAL LABORATORY TECHNOLOGY) DEGREE EXAMINATION

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

I. Elaborate on: **(3 x 10 = 30)**

1. Describe the process of Glycolysis. What are the key enzymes of glycolysis? How many ATP are formed in aerobic and anaerobic glycolysis?
2. What are the fat soluble vitamins? Describe the sources, biochemical functions, requirements and deficiency manifestations of vitamin 'A'.

II. Write Short Notes on : **(10 x 5 = 50)**

1. Beriberi.
2. Benedict's test.
3. Mutarotation.
4. Anticoagulants.
5. Enzyme profile in myocardial infarction.
6. Bile acids.
7. Glucose tolerance test.
8. Lipoproteins.
9. Important compounds derived from cholesterol.
10. Carnitine.

III. Short Answer Questions: **(10 x 2 = 20)**

1. Name the unsaturated fatty acids.
2. What are Sulphur containing amino acids?
3. Name two examples of heteropolysaccharides.
4. Name four phospholipids.
5. Normal blood level of urea and creatinine.
6. Coenzyme forms of B12.
7. Which vitamin is needed for transamination reaction?
8. Lipotropic factors.
9. Examples of Epimers.
10. What are the isoenzymes of creatine kinases?

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[KZ 0811] **AUGUST 2011** **Sub. Code: 5017**

B.Sc. (MEDICAL LABORATORY TECHNOLOGY) DEGREE EXAMINATION

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

I. Elaborate on: **(3 x 10 = 30)**

1. How is Glycogen Metabolized? Briefly describe the regulation of Glycogen Metabolism.
2. Discuss the causes, clinical symptoms and laboratory findings of hypocalcemia.
3. Enumerate the different types of oxidation of fatty acids.
   Describe in detail β- oxidation of palmitic acid and add a note on energetics of palmitic acid.

II. Write notes on: **(8 x 5 = 40)**

1. Regulation of growth hormone.
2. Fatty acid synthase complex.
3. HDL cholesterol.
4. Functions of Vitamin C.
5. Hartnup disease.
6. Role of thiamine in carbohydrate metabolism.
7. Glucose tolerance test.
8. Tyrosinemia.

III. Short Answers on: **(10 x 3 = 30)**

1. Define epimerism with examples.
2. Give two functions of thyroxine.
3. Write four enzymes for which biotin acts as coenzyme.
4. Define glycolysis.
5. What are isoenzymes?
6. Functions of Vitamin K.
7. Role of bile in lipid digestion.
8. Write the enzymes defective in:
   (a) Niemann pick disease. (b) Fabry disease.
9. What are ketogenic amino acids? Give examples.
10. Write normal values of:
    (a) Fasting blood glucose (b) Post prandial blood glucose.

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[LA 0212] **FEBRUARY 2012** **Sub. Code: 5017**

B.Sc. (MEDICAL LABORATORY TECHNOLOGY) DEGREE EXAMINATION

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time : Three Hours **Maximum : 100 marks**

Answer ALL questions

I. Elaborate on: **(3 x 10 = 30)**

1. Write in detail the chemistry, sources daily requirements, biochemical functions and deficiency manifestations of folic acid.
2. Explain in detail the formation and disposal of ammonia in the body and add a note on urea cycle disorders.
3. What are aromatic amino acids? Describe in detail the metabolism of tyrosine.

II. Write notes on: **(8 x 5 = 40)**

1. Transport proteins.
2. Phenyletonuria.
3. Deficiency manifestations of Thiamine.
4. Electrophoresis.
5. Biochemical function of Vitamin C.
6. Prostaglandins.
7. Significance of Tricarboxylic acid cycle.
8. Lipoproteins.

III. Short Answers on: **(10 x 3 = 30)**

1. Wald’s Visual Cycle.
2. Ceruloplasmin.
3. Coenzyme forms of Niacin.
4. Maple syrup urine disease.
5. Glycated hemoglobin.
6. Galactosemia.
7. Fatty Liver.
8. Structure of Glycogen.
9. Any two compounds derived from cholesterol.
10. Metabolic effects of thyroid hormones.

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[LB 0212] **AUGUST 2012** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY-I

Q.P. Code : 725017

Time : Three hours **Maximum : 100 marks**

(180 Mins) Answer ALL questions in the same order.

I. Elaborate on:	**Pages (Max.)**	**Time (Max.)**	**Marks (Max.)**
1. Explain in detail the steps involved in glycolysis. Mention the energetics in both aerobic and anaerobic conditions.	7	20	10
2. Describe the catabolism of heme. Add a note on congenital hyperbilirubinemia.	7	20	10
3. Write the dietary sources, daily requirement, functions and deficiency manifestations of iron.	7	20	10
II. Write notes on:			
1. Hypoglycemia.	4	10	5
2. Calcium homeostasis.	4	10	5
3. Phenylketonuria.	4	10	5
4. 2,3 Bisphosphoglycerate.	4	10	5
5. Functions of Growth hormone.	4	10	5
6. Purine salvage pathway.	4	10	5
7. CSF analysis.	4	10	5
8. Cholesterol synthesis.	4	10	5
III. Short answers on:			
1. Mention the derivatives of tryptophan.	2	4	3
2. Write the normal value of: i) blood urea ii) serum creatinine iii) serum uricacid.	2	4	3
3. Differentiate type I and type II diabetes mellitus.	2	4	3
4. Name the key enzymes of glycolysis.	2	4	3
5. Draw the normal oxygen dissociation curve.	2	4	3
6. Write the hormones secreted by hypothalamus.	2	4	3
7. Mention any three glycogen storage diseases.	2	4	3
8. Biochemical diagnosis of hypothyroidism.	2	4	3
9. Principle of electrophoresis.	2	4	3
10. Myoglobin.	2	4	3

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[LC 0212] FEBRUARY 2013 Sub. Code: 5017

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY-I

Q.P. Code : 725017

Time : Three hours **Maximum : 100 marks**

Answer ALL questions.

I. Elaborate on: (3X10=30)

1. Explain in detail the different steps in the anaerobic degradation of glucose. Add a note on its energetics.
2. How is cholesterol synthesized in the body? What are the functions of cholesterol?
3. Write the dietary sources, daily requirement, functions and deficiency features of calcium.

II. Write Notes on: : (8X5=40)

1. Functions of glutathione
2. Complications of Diabetes mellitus
3. Purine salvage pathway
4. Hypothyroidism
5. Acute intermittent porphyria
6. Transamination reactions
7. Fatty acid synthase complex
8. Synthesis of prostaglandins

III. Short Answers on: (10X3=30)

1. Mention any three glycogen storage disorders
2. Name three aminoacids involved in creatinine synthesis
3. What are the derivatives of tryptophan
4. Mention the functions oxytocin
5. Orotic aciduria
6. Mention any three applications of electrophoresis
7. What are the hormones of adrenal cortex
8. Role of bile salts in digestion of lipids
9. Importance of 2,3 bisphosphoglycerate
10. Rate limiting step of heme synthesis

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[LD 0212] **AUGUST 2013** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II –BIOCHEMISTRY

***Q.P. Code :* 725017**

Time: Three hours **Maximum : 100 Marks**

Answer All Questions

I. Elaborate on: **(3 x 10 = 30)**

1. Explain in detail about synthesis, Transport Biochemical function of hormones of Adrenal Cortex with the abnormalities of adrennocortical function.
2. Write about Digestion absorption of Lipid
3. Elaborate Biosynthesis of Cholesterol

II.Write notes on **(8 X 5 = 40)**

1. Explain Emulsification
2. Give an account on Transamination
3. Explain Prostaglandin with its biochemical function
4. Write notes on Biological importance of Carbhohydrate
5. Explain Glucose tolerance test
6. Write about calcium
7. Give an account on Hamoglobinopathies
8. Write notes on Estrogen

III.Short notes on **(10 X 3 = 30)**

1. Mathemaglobin
2. Plasma protein
3. Polysaccharide
4. Denaturation
5. Classify Mineral
6. Difference between DNA and RNA
7. Epimer
8. Electrophoresis
9. Cushing syndrome
10. Parkinson’s disease

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[LE 0212] **FEBRUARY 2014** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II –BIOCHEMISTRY-I

Q.P. Code : 725017

Time: Three hours **Maximum : 100 Marks**

Answer All Questions

I. Elaborate on: **(3 x 10 = 30)**

1. Describe the role of various factors involved in maintenance of normal Blood glucose level.
2. Describe the chemistry and biochemical functions of prostaglandins.
3. Write a note on Steroid and non Steroid hormones.

II.Write notes on: **(8 X 5 = 40)**

1. What is calcitonin? Give the biochemical functions of calcitonin
2. Biosynthesis of Pyrimidine
3. Ketone bodies formation and its clinical significance
4. Cori cycle
5. Eicosanoids and their functions
6. What is porphyria? Explain the types of porphyria
7. Transamination and deamination of amino acids
8. Mechanism of haemoglobin formation

III. Short notes on: **(10 X 3 = 30)**

1. Glycogenolysis
2. Clinical Functions of iron
3. Different forms of Calcium in blood
4. Functions of Mineralocorticoids
5. What is Diabetes Insipidus
6. Pompes disease
7. Name the enzyme and catalytic factors involved in decarboxylation of pyruvate
8. What is beta oxidation?
9. Uses of Haeme
10. Triglycerides and its clinical function

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[LF 0212] **AUGUST 2014** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code : 725017

Time: Three hours **Maximum : 100 Marks**

Answer All Questions

I. Elaborate on: **(3 x 10 = 30)**

1. Explain synthesis of Urea.
2. Describe Digestion and absorption of Lipids.
3. Write about hormones of Adrenal cortex.

II. Write notes on: **(8 x 5 = 40)**

1. Active transport of Carbhohydrate.
2. Degradation of Purine.
3. β ThalaSeemia.
4. Degradation of Creatinine.
5. Oxygen dissociation Curve.
6. Functions of prostaglandin.
7. Formation of Glycogen.
8. Transport of Gases.

III. Short notes on: **(10 x 3 = 30)**

1. Methamoglobin.
2. Deficiency of Iron.
3. Sickel cell anemia.
4. Glucose.
5. Carboxy Haemoglobin.
6. Pyrimidine.
7. Sex hormone.
8. Haem.
9. Proteins.
10. Myoglobin.

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[LG 0215] **FEBRUARY 2015** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code : 725017

Time: Three Hours **Maximum : 100 Marks**

Answer All Questions

I. Elaborate on: **(3 x 10 = 30)**

1. Write in detail about Thyroid Hormone.
2. Draw and explain Glycolysis.
3. Explain about β oxidation of Fatty Acid.

II. Write notes on: **(8 x 5 = 40)**

1. Biosynthesis of Haem.
2. Von Griek's disease.
3. Diabetes mellitus.
4. Digestion of Carbohydrate.
5. Functions of acute Phase reactants.
6. Functions of prostaglandin.
7. Synthesis of Creatinine.
8. Transamination.

III. Short notes on: **(10 x 3 = 30)**

1. Define Carbohydrate.
2. Diabetes Insipidus.
3. Eicosanoids.
4. Classify Mineral.
5. Porphyrias.
6. Functions of sodium.
7. Glycogen.
8. Cerebrospinal Fluids.
9. Calcium.
10. Glycogen.

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[LH 0815] **AUGUST 2015** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. Define and classify proteins. Illustrate protein catabolism.
2. Disorders associated with RBCs.
3. Illustrate female hormones.

II. Write notes on: **(8 x 5 = 40)**

1. Biosynthesis of purines.
2. Catabolism of haem.
3. Discuss about composition of CSF.
4. Deficiency disorders of calcium.
5. Ozone formation in carbohydrates.
6. Quantitative tests for carbohydrates.
7. Glycolysis.
8. Procedure involved in electrophoresis.

III. Short answers on: **(10 x 3 = 30)**

1. Metabolism.
2. Hormones.
3. Hemostasis.
4. Vitamins.
5. Prostaglandins.
6. Dermatitis.
7. Proteinuria.
8. Atherosclerosis.
9. Sources of vitamin E.
10. Hyponatremia.

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[LI 0216] FEBRUARY 2016 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. TCA cycle.
2. Illustrate pituitary gland.
3. Define and classify lipids with examples.

II. Write notes on: **(8 x 5 = 40)**

1. Transamination.
2. Metabolic effects of adrenaline.
3. Coagualation of blood.
4. Biosynthesis of porphyrins.
5. Classification of carbohydrates.
6. Deficiency diseases associated with iron.
7. Color reactions of amino acids.
8. Gastric pepsin and pancreatic trypsin.

III. Short answers on: **(10 x 3 = 30)**

1. Isotopes.
2. Thalassemia.
3. Hyperparathyroidism.
4. Sources of Vitamin A.
5. Hydrocarbons.
6. Cushing’s syndrome.
7. Early symptoms of dry and wet Beriberi.
8. Electrophoresis.
9. Ketone bodies.
10. Effects of Glucocorticoids on carbohydrate metabolism.

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[LJ 0816] AUGUST 2016 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. What are the fat soluble vitamins? Describe the sources, Biochemical functions and deficiency manifestations of vitamin 'D.
2. What is glycolysis? Discuss the reactions of glycolysis.
3. Classify amino acids. Describe the metabolism of phenylalanine and defects associated with it.

II. Write notes on: **(8 x 5 = 40)**

1. Describe Vanden Berg reaction.
2. Write about niacin and it's function.
3. Write in details about transamination.
4. Explain phenylketonuria.
5. Write in details about transport proteins.
6. Write about ceruloplasmin and it's clinical significance.
7. Source and Biochemical function of calcium.
8. What is hypothyroidism?

III. Short answers on: **(10 x 3 = 30)**

1. Define rickets.
2. Epimerism with examples.
3. Name the essential fatty acids.
4. What are the Bence – Jones proteins?
5. What are the methods of separation of lipoprotein?
6. What is isoenzyme?
7. Role of iron.
8. Write about Wilson's disease.
9. Explain bile salts.
10. Any two compounds derived from cholesterol.

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[LK 0217] FEBRUARY 2017 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. Write the dietary source, daily requirement, functions and deficiency of Iron.
2. Classify diabetes mellitus. Describe in details about the regulation of blood glucose.
3. Describe the source, daily requirement, chemistry and deficiency manifestations of ascorbic acid in the body.

II. Write notes on: **(8 x 5 = 40)**

1. Explain electrophoresis.
2. Biosynthesis of haem.
3. Von Grieks disease.
4. Describe the plasma protein.
5. Explain ß – thalassaemia.
6. Biochemical analysis of CSF.
7. Write note on serum calcium and its clinical significance.
8. Write in detail about ketone bodies.

III. Short answers on: **(10 x 3 = 30)**

1. Beer – Lambert's Law.
2. Name the bile acids and bile salts.
3. Wald's visual cycle.
4. Give the functions of thyroxin.
5. Define Fabry disease.
6. Classify minerals.
7. What is hypoglycemia?
8. Maple syrup urine disease.
9. Function of niacin.
10. Cerebro spinal fluid.

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[LL 0817] AUGUST 2017 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. What is the normal plasma glucose level? What are the criteria for diagnosing diabetes mellitus? Describe how blood glucose level is regulated?
2. Describe the digestion and absorption of lipids.
3. How is iron absorbed, transported and stored in our body? Describe the condition in which there is iron deficiency and iron excess.

II. Write notes on: **(8 x 5 = 40)**

1. Describe transamination reaction with 2 examples. Name the coenzyme involved.
2. How is Carbondioxide transported in blood?
3. Write the steps of glycolysis.
4. Name the thyroid hormones. How is the level of thyroid hormone regulated?
5. Write the steps of uric acid formation.
6. Write the steps of cholesterol synthesis up to its rate limiting step.
7. Draw a diagram illustrating carnitine transport.
8. Biological function of female sex hormones.

III. Short answers on: **(10 x 3 = 30)**

1. Name three acute phase reactants.
2. Draw the oxygen dissociation curve.
3. Name the compounds formed from heme.
4. Name the disaccharide breaking enzymes present in intestine.
5. Name the non protein nitrogenous substances.
6. List the hormones produced by adrenal glands.
7. Name any three porphyrias.
8. Name three types of jaundice.
9. How is cerebrospinal fluid formed?
10. What deprivation test is done for the diagnosis of which disease? What was measured in this test?

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[LM 0218] FEBRUARY 2018 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. How bilirubin is formed in the body? How bilirubin is excreted out of body?
2. List the hormones produced by the pituitary. How the secretion of these hormones regulated? Mention one biological function for each hormone.
3. Write the steps of anaerobic glycolysis. Which instrument and which sample are used to measure the end product of anaerobic glycolysis in hospital clinical biochemistry laboratory or intensive care unit?

II. Write notes on: **(8 x 5 = 40)**

1. Salvage pathways for purine synthesis.
2. List the parameters estimated in Cerebrospinal fluid – CSF analysis and write their normal values in CSF.
3. What will happen to TSH, free T4, free T3 levels in hypo and hyper thyroidism?
4. Dexamethasone suppression test.
5. How is creatinine formed?
6. How is iron absorbed?
7. Describe the function of estrogen.
8. What is the normal uric acid level in plama? How is uric acid excreted? What are the clinical features of increased uric acid level?

III. Short answers on: **(10 x 3 = 30)**

1. Write the rate limiting step of cholesterol synthesis.
2. Acute intermittent porphyria is a deficiency of which enzyme and which substances accumulated in this condition?
3. Name the bile acids. What is the function of bile acid?
4. Name three glycogen storage disorders.
5. List the special properties of fetal hemoglobin.
6. Name the analytes measured by flame photometer.
7. Name three hormones increasing blood glucose level.
8. Name two transaminases. Name the coenzyme of transaminases.
9. What are the features of tetany?
10. Name three prostaglandins.

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[LN 0818] AUGUST 2018 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. What are the diagnostic criteria for diagnosing diabetes mellitus? Classify diabetes mellitus. Describe the main classes.
2. What is the normal calcium level in serum? How is this regulated?
3. Describe the urea cycle with a neat diagram.

II. Write notes on: **(8 x 5 = 40)**

1. Steps of beta oxidation in mitochondria.
2. Name the hormones formed from Tyrosine. How they are formed?
3. Which parameters are measured to assess the status of iron metabolism in our body and what are their implications?
4. List the sex hormones and their actions.
5. Draw the electrophoresis pattern of normal serum. List the protein found in each band.
6. How to find the type of jaundice with Total, direct, indirect bilirubin results?
7. ACTH stimulation test.
8. Name the hormones produced by pancreas and mention their functions.

III. Short answers on: **(10 x 3 = 30)**

1. Name the enzyme digesting proteins in gasterointestinal tract.
2. What is Thalassemia?
3. Name the lipid digesting enzymes secreted by pancreas.
4. Name the monosaccharides found in human.
5. Draw the diagram of discoid micelle formed during the digestion and absorption of lipids.
6. What is M band in serum protein electrophoresis?
7. Name one substance each used for producing Ion Selective electrode for Na+, K+ and pH.
8. What is hemochromatosis?
9. What are negative acute phase reactants?
10. Why flame photometer is suitable for Na+ and K+ estimation?

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[LO 0219] FEBRUARY 2019 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. Write in detail about the digestion and absorption of proteins.
2. Give an account on the biosynthesis of fatty acids.
3. Explain the pathway of breakdown of glucose.

II. Write notes on: **(8 x 5 = 40)**

1. Serum electrophoresis.
2. Structure of haemoglobin.
3. Composition of cerebrospinal fluid in disease.
4. Pituitary hormones.
5. Diabetes mellitus.
6. Transamination.
7. Interconversion of monosaccharides.
8. Qualitative analysis of abnormal urine.

III. Short answers on: **(10 x 3 = 30)**

1. Biochemical role of thyroid hormones.
2. Facilitated transport.
3. Plasma proteins.
4. HMP shunt.
5. Normal serum levels of calcium and phosphorous.
6. Acute intermittent porphyria.
7. Functions of acute phase reactants.
8. Carnitine transport.
9. Salivary amylase in digestion.
10. Beta oxidation of fatty acids.

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[LP 0819] AUGUST 2019 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. Explain the process of digestion and absorption of lipids.
2. Brief note on the role of biologically important hormones.
3. Discuss about glycogen metabolism.

II. Write notes on: **(8 x 5 = 40)**

1. Calcium homeostasis.
2. Oxygen dissociation curve - Explain.
3. Adrenocorticotrophic hormone stimulation test.
4. Glycogen storage disease.
5. Structure and functions of myoglobin.
6. Hormonal influence on blood glucose level.
7. Salvage pathway for purine synthesis.
8. Beta oxidation of fatty acids.

III. Short answers on: **(10 x 3 = 30)**

1. Active transport.
2. Methaemoglobin.
3. Hereditary porphyria.
4. Absorption of iron.
5. Thalassemia.
6. Prostaglandins.
7. Cerebrospinal fluid.
8. TCA cycle.
9. Flame photometer.
10. Pancreatic lipase.

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[LQ 0220] FEBRUARY 2020 **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR

PAPER II – BIOCHEMISTRY - I

Q.P. Code: 725017

Time: Three Hours **Maximum: 100 Marks**

Answer all questions

I. Elaborate on: **(3 x 10 = 30)**

1. Discuss about the digestion and absorption of carbohydrates
2. Explain the pathway of cholesterol synthesis. Add a note on fate of cholesterol in the body.
3. Write the dietary sources of iron, daily requirements and explain the iron absorption, transport and storage.

II. Write notes on: **(8 x 5 = 40)**

1. Deficiency manifestations of mineral disorders.
2. Metabolism of phenylalanine and tyrosine.
3. Adrenal hormones and their functions.
4. Mechanism of transport of gases in our body.
5. Urea cycle.
6. Eicasanoids.
7. Types of porphyrias.
8. Pathway of pyrimidine degradation.

III. Short answers on: **(10 x 3 = 30)**

1. Fetal hemoglobin.
2. Sex hormones and their actions.
3. Gluconeogenesis.
4. Normal levels of serum calcium and phosphorous.
5. Emulsification.
6. Ketone bodies.
7. Hemochromatosis.
8. Spectrophotometer.
9. Diabetes insipidus.
10. Micelle.

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THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0321] MARCH 2021 Sub. Code: 5017

(AUGUST 2020 EXAM SESSION)

B.Sc. MEDICAL LABORATORY TECHNOLOGY

SECOND YEAR (From 2010-2011 onwards)

PAPER II – BIOCHEMISTRY - I

Q.P. Code : 725017

Time: Three hours **Answer ALL Questions** **Maximum: 100 Marks**

I. Elaborate on: **(3 x 10 = 30)**

1. Explain in detail about urea cycle and the clinical importance of elevated blood urea.
2. Write the dietary sources of Iron, daily requirements and explain the iron absorption, transport and storage.
3. What is glycolysis? Write the reactions and energetics of glycolysis.

II. Write notes on: **(8 x 5 = 40)**

1. Steps in cholesterol synthesis.
2. Biochemical functions of thyroid hormones, hypo and hyper thyroidism.
3. Heme catabolism.
4. Growth hormone and its function.
5. Energetics of TCA cycle.
6. Normal serum level of Uric acid, causes and clinical features of increased Uric acid level.
7. Glycogen synthesis.
8. Haemoglobin derivatives.

III. Short answers on: **(10 x 3 = 30)**

1. Define electrophoresis, mention its uses.
2. Creatinine and its normal serum level.
3. Biochemical functions of phosphate.
4. Myoglobin.
5. Diabetes insipidus.
6. Congenital erythropoietic porphyria.
7. Name 3 prostaglandins and its functions.
8. Normal serum level of calcium and clinical features of tetany.
9. Glucose transporters.
10. Albumin and its function.

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THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0222] **FEBRUARY 2022** **Sub. Code: 5017**
(AUGUST 2021 EXAM SESSION)

B.Sc. MEDICAL LABORATORY TECHNOLOGY
SECOND YEAR (From 2010-2011 onwards)
PAPER II – BIOCHEMISTRY - I
Q.P. Code : 725017

Time: Three hours **Answer ALL Questions** **Maximum: 100 Marks**

I. Elaborate on: **(3 x 10 = 30)**

1. List the hormones produced by the pituitary. How the secretion of these hormones regulated? Mention one biological function for each hormone.
2. What are the fat soluble vitamins? Describe the sources, Biochemical functions and deficiency manifestations of vitamin D.
3. TCA cycle.

II. Write notes on: **(8 x 5 = 40)**

1. Write about folic acid and its function.
2. Write notes on Galactosemia.
3. Name the hormones produced by pancreas and mention their functions.
4. Structure and function of Hemoglobin.
5. How is creatinine formed?
6. Lipid storage diseases.
7. Biological function of female sex hormones.
8. Biochemical analysis of CSF.

III. Short answers on: **(10 x 3 = 30)**

1. Facilitated transport.
2. Plasma proteins.
3. HMP shunt.
4. Normal serum levels of calcium and phosphorous.
5. Acute intermittent porphyria.
6. Features of hypothyroidism
7. Name the acute phase reactants.
8. Flame photometer
9. Wald’s visual cycle
10. Name the Mucopolysaccharides

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THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0922] SEPTEMBER 2022 Sub. Code: 5017
(FEBRUARY 2022 & AUGUST 2022 EXAM SESSIONS)

B.Sc. MEDICAL LABORATORY TECHNOLOGY
SECOND YEAR (Regulation from 2010-2011)
PAPER II – BIOCHEMISTRY - I
Q.P. Code : 725017

Time: Three hours **Answer ALL Questions** **Maximum: 100 Marks**

I. Elaborate on: **(3 x 10 = 30)**

1. Explain in detail about glycogen metabolism.
2. Explain in detail about the digestion and absorption of Lipids.
3. List the Thyroid Function test. Explain in detail about the biochemical functions of thyroid hormone.

II. Write notes on: **(8 x 5 = 40)**

1. Absorption of Iron.
2. Hormonal influences on blood glucose level.
3. Digestion of proteins and absorption of aminoacids.
4. Types of prostaglandins and its uses.
5. Urea synthesis.
6. Glycogen Storage disorders.
7. Biochemical functions of calcium.
8. Oxygen Dissociation curve.

III. Short answers on: **(10 x 3 = 30)**

1. Methemoglobin and Carboxy hemoglobin.
2. Energetics of beta oxidation of fatty acid.
3. Mention the conditions in which blood urea is elevated.
4. M Band in protein electrophoresis.
5. Name three positive acute phase reactants.
6. Normal reference range of total, direct and indirect bilirubin.
7. Name the Purines and pyrimidines.
8. Sources and normal level of phosphates.
9. Normal composition of Cerebrospinal fluid.
10. Name the Bile salts and Pigments.

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THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 0423] **APRIL 2023** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY
SECOND YEAR (Regulations 2010-2011 & 2018-2019 onwards)
PAPER II – BIOCHEMISTRY - I
Q.P. Code: 725017

Time: Three hours **Answer ALL Questions** **Maximum: 100 Marks**

I. Elaborate on: **(3 x 10 = 30)**

1. Write the Dietary Sources of Calcium, Daily Requirements, Normal Serum Level and Explain the Regulation Of Calcium.
2. What is the Normal Plasma Fasting and Post Prandial Glucose Level? Describe the Regulation of Blood Glucose.
3. Explain in detail about Heme Synthesis and its Breakdown.

II. Write notes on: **(8 x 5 = 40)**

1. Urea cycle.
2. Significance of HMP shunt pathway.
3. Name and write the functions of Bile salts.
4. Creatine synthesis.
5. Formation and composition of Cerebrospinal fluid in diseases.
6. Absorption of Iron.
7. Digestion of Proteins.
8. Various types of Jaundice.

III. Short answers on: **(10 x 3 = 30)**

1. Methemoglobin.
2. Energetics in Glycolysis.
3. Functions of Estrogen.
4. Principle of Electrophoresis.
5. Enumerate the Plasma Proteins along with their normal values.
6. Biochemical functions of Thyroid hormones.
7. Name the Purines and Pyrimidines.
8. Name the Ketone bodies and its significance.
9. Carnitine transport.
10. Rate limiting step in Cholesterol synthesis.

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THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY

[AHS 1123] **NOVEMBER 2023** **Sub. Code: 5017**

B.Sc. MEDICAL LABORATORY TECHNOLOGY
SECOND YEAR (Regulations 2010-2011 & 2018-2019 onwards)
PAPER II – BIOCHEMISTRY - I
Q.P. Code: 725017

Time: Three hours **Answer ALL Questions** **Maximum: 100 Marks**

I. Elaborate on: **(3 x 10 = 30)**

1. Classify Diabetes Mellitus. Write about investigations related to Diabetes Mellitus.
2. Describe the Digestion and Absorption of Proteins.
3. Write the sources, functions, deficiency manifestations of Calcium. What is the Normal Blood Calcium Level?

II. Write notes on: **(8 x 5 = 40)**

1. Biochemical tests for Thyroid functions.
2. Reactions of Glycolysis.
3. Transport of gases.
4. Types of Jaundice.
5. Give the range of Fasting, Random and Post Prandial Blood Glucose levels and its significance.
6. Types and functions of Hemoglobin.
7. Factors influencing absorption of Iron.
8. Absorption of Lipids.

III. Short answers on: **(10 x 3 = 30)**

1. Plasma proteins.
2. Transamination.
3. Sickle Cell Anaemia.
4. Active transport of Glucose.
5. Enumerate the Female sex hormones.
6. Principle of Electrophoresis.
7. C - Reactive Protein.
8. Name the Bile salts and Bile pigments.
9. Name the Purine and Pyrimidines.
10. Bence Jones Protein.

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