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| <b>Branch Name:</b>          | B.Sc. (MLT)    |
| <b>Program Code:</b>         | AS101          |
| <b>Course Title:</b>         | Biochemistry-I |
| <b>Course Code:</b>          | 1AS1010102     |
| <b>Pre-requisite Course:</b> | NONE           |

**Course Objectives:**

1. Students must understand the basic principles of Biochemistry and the biochemical processes that take place in the human body.
2. Student must understand biological markers used in disease diagnosis and prognosis.
3. Student must acquire practical skills in biochemical techniques.

**Teaching and Examination Scheme:**

| Teaching Scheme<br>(Hours per week) |                 |                  |        | Evaluation Scheme (Marks) |                          |                          |                          |                  |
|-------------------------------------|-----------------|------------------|--------|---------------------------|--------------------------|--------------------------|--------------------------|------------------|
| Lecture<br>(L)                      | Tutorial<br>(T) | Practical<br>(P) | Credit | Theory (Marks)            |                          | Practical (Marks)        |                          | Total<br>(Marks) |
|                                     |                 |                  |        | University<br>Assessment  | Continuous<br>Assessment | University<br>Assessment | Continuous<br>Assessment |                  |
| 03                                  | -               | 02               | 04     | 50                        | 50                       | 25                       | 25                       | 150              |

**THEORY SYLLABUS**

**Course Contents:**

| Unit No | Topic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Total Hours | Weightage (%) |
|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------|
| I       | <b>Enzymes</b> <ul style="list-style-type: none"> <li>Define and classify with examples, active site, cofactor, proenzyme</li> <li>List the factors affecting enzyme activity</li> <li>Define isoenzymes, enzymology (clinical significance of enzymes)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3           | 6             |
| II      | <b>Carbohydrate Chemistry &amp; Metabolism</b> <ul style="list-style-type: none"> <li>Define carbohydrates, classify carbohydrates with examples, explain glycosidic bond</li> <li>Illustrate composition, sources, and functions of monosaccharides, disaccharides, oligosaccharides, and polysaccharides.</li> <li>Illustrate glycolysis-aerobic, anaerobic, citric acid cycle, substrate phosphorylation</li> <li>Elaborate glycogen metabolism –glycogenesis, glycogenolysis, metabolic disorders of glycogen, gluconeogenesis, Cori's cycle</li> <li>Summarize hormonal regulation of glucose, glycosuria, diabetes mellitus</li> </ul>                                                                                             | 8           | 18            |
| III     | <b>Lipid Chemistry &amp; Metabolism</b> <ul style="list-style-type: none"> <li>Define and classify lipids</li> <li>Functions of Fatty acids, Triacylglycerol, Phospholipids, cholesterol</li> <li>Essential fatty acids and their importance</li> <li>Explain Lipoproteins: definition, classification, function, ketone bodies</li> <li>Fat metabolism in adipose tissues</li> <li>Elaborate ketone body metabolism: formation (ketogenesis), utilization (ketolysis), ketosis</li> <li>Summarize cholesterol metabolism: synthesis, degradation, cholesterol transport</li> <li>Define Hypercholesterolemia, list its effects, causing agents, common hyperlipoproteinemia, Lipoproteins</li> <li>Explain about fatty liver</li> </ul> | 8           | 18            |

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|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
| IV | <b>a) Amino-acid Chemistry &amp; Amino acid and protein metabolism</b> <ul style="list-style-type: none"> <li>Define and classify amino acids</li> <li>Define peptides and explain peptide bonds, list the biologically important peptides.</li> <li>Define and classify proteins, enumerate functions of proteins.</li> <li>Define Catabolism of amino acids- transamination, deamination</li> <li>Illustrate fate of ammonia, transport of ammonia, Urea cycle</li> <li>Outline the specialized products formed from amino acids</li> </ul> | 7 | 20 |
|    | <b>b) Hormones</b> <ul style="list-style-type: none"> <li>Hormones basic concepts in metabolic regulation with examples (Insulin)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  | 2 |    |
| V  | <b>a) Vitamins</b> <ul style="list-style-type: none"> <li>Define vitamins and classify them according to solubility</li> <li>List the sources, Coenzyme forms, functions, Recommended Dietary Allowance(RDA)</li> <li>Tell about digestion, absorption and transport, deficiency and toxicity of individual vitamins</li> </ul>                                                                                                                                                                                                               | 6 | 22 |
|    | <b>b) Minerals</b> <ul style="list-style-type: none"> <li>Define minerals and list the sources for mineral and their Recommended Dietary Allowance</li> <li>Describe about digestion, absorption, transport, excretion of various minerals</li> <li>List the functions and disorders of individual minerals–Calcium, phosphate, iron, magnesium, manganese, fluoride, selenium, zinc, molybdenum, copper</li> </ul>                                                                                                                           | 4 |    |
| VI | <b>a) Acid-base balance</b> <ul style="list-style-type: none"> <li>Define acid, base and pH</li> <li>Handerson HasselBalch equation, indicators</li> <li>Define buffers and describe buffer systems of the body (bicarbonate buffer system)</li> <li>Elaborate about the role of lungs and kidneys in acid-base balance.</li> <li>Acid base disorders</li> </ul>                                                                                                                                                                              | 2 | 16 |
|    | <b>b) Organ Function Tests</b> <ul style="list-style-type: none"> <li>Describe the biochemical functions of kidney and the principal of Renal Function Tests</li> <li>Describe the biochemical functions of liver and the principal of Liver Function Tests</li> <li>Principal of Cardiac Function Tests</li> </ul>                                                                                                                                                                                                                           | 5 |    |

### PRACTICAL SYLLABUS

| Units | Practical Topics –Demonstrations                                                                                                                                                                               | Total Hours | Weightage (%) |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------|
| I     | <ul style="list-style-type: none"> <li>Laboratory safety</li> <li>Laboratory apparatus: Glasswares, Pipettes, centrifuge, colorimeter, spectrophotometer, Electrophoresis unit, Chromatography unit</li> </ul> | 4           | 13            |
| II    | <ul style="list-style-type: none"> <li>Sample Collection- Blood, Random urine sample, 24 hour urine sample, Preservatives and Anticoagulants</li> </ul>                                                        | 2           | 7             |
| III   | <ul style="list-style-type: none"> <li>Preparation of Solutions (Molar, Normal, Percentage and Saturated)</li> <li>Preparation of Buffers,</li> <li>pH determination</li> </ul>                                | 2           | 7             |
| IV    | Reactions of Carbohydrates (Glucose,Fructose,Lactose,Sucrose)                                                                                                                                                  | 6           | 20            |
|       | Urine Analysis–                                                                                                                                                                                                |             | 20            |

|    |                                                                                                                                                                                                                                                                                                                            |    |    |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|
| V  | <ul style="list-style-type: none"> <li>• Normal constituents (Organic &amp; Inorganic)</li> <li>• Abnormal constituents</li> </ul>                                                                                                                                                                                         | 6  |    |
| VI | Quantitative Estimation and Clinical Significance of: <ul style="list-style-type: none"> <li>• PlasmaGlucose</li> <li>• BloodUrea</li> <li>• SerumCreatinine</li> <li>• Electrolytes</li> <li>• Serumbilirubin</li> <li>• Total Protein, Albumin, Globulin and AG Ratio</li> <li>• Lipid profile</li> <li>• ABG</li> </ul> | 10 | 33 |

#### Text Books:

- Text book of Medical Laboratory Technology: Paraful B. Godkar.
- Textbook of Biochemistry for Medical students: Vasudevan and Sreekumari.
- Biochemistry for Medical Laboratory Technology Students: Harbans Lal.
- Biochemistry for Medical students: Dr. SK Gupta
- Manual of Practical Biochemistry: Rafi MD
- Textbook of Biochemistry: U Satyanarayana

#### Reference Books:

- Harper's Biochemistry: R. K. Murray and Grannor
- Textbook of Clinical chemistry: Teitz
- Medical Laboratory Technology: Kanai L. Mukherjee

#### List of Open-Source Software/learning website:

#### Course Learning Outcomes (CLO):

1. Students will be able to explain and apply the basic principles of biochemistry and describe the biochemical processes occurring in the human body.
2. Students will demonstrate the ability to interpret and utilize biological markers for the diagnosis and prognosis of diseases.
3. Students will develop practical laboratory skills, using biochemical techniques to analyze and solve biological problems effectively.

| Course Outcomes | Description                                                                                                                                   | Bloom's Taxonomy Level          |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| COL1            | Explain the concepts of calculus. Use the concepts of calculus to determine the power series expansion of functions and evaluation of limits. | Understanding(2)<br>Applying(3) |
| COL2            | Use the concepts partial derivatives to solve the differential equations appearing in Engineering fields.                                     | Applying(3)                     |
| COL3            | Use the concept of Reduction formula to find surface area and volumes of revolution.                                                          | Applying(3)                     |
| COL4            | Solve improper integrals with the help of beta and gamma functions                                                                            | Applying(3)                     |
| COL5            | Use the concept of double integration to solve area and volume of surfaces.                                                                   | Applying(3)                     |