

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8**  
(Affiliated to Krishna University, Machilipatnam)

**SYLLABUS**

**Subject: Biochemistry**  
**Course Title: Biomolecules**  
**No. of Hrs: 60**

**LTP:400**

**Semester: I**  
**Course Code: 21BCCCBM13**  
**Credits :3**

**Objectives**

- To acquire knowledge of the biological importance of water, pH, and buffers found in living cells
- To impart basic knowledge of biomolecules and their importance in biological systems
- To prepare solutions, buffers, and dilutions

**Course Outcomes**

**CO1:** Represent the biomolecules in structural form

**CO2:** Explain the classification of biomolecules

**CO3:** Outline the physico-chemical properties of biomolecules

**CO4:** Summarize the importance of biomolecules in living organisms

**Unit I: Biophysical Concepts**

**(10hrs)**

Basic Classification of biomolecules, Water as a biological solvent and its role in Industrial and biological processes. laboratory grade water, Total dissolved salts (TDS), The biological relevance of pH, measurement of pH, Handerson Hasselbalch equation. Buffers-Importance of buffers in biological systems.

**Unit II: Carbohydrates**

**(10hrs)**

Carbohydrates: Classification, monosaccharides, D and L designation, open-chain and cyclic structures, epimers and anomers, mutarotation, reactions of carbohydrates (due to functional groups - hydroxyl, aldehyde, and ketone. Glycosides, Structure and biological importance of disaccharides (sucrose, lactose, maltose) Structural polysaccharides (cellulose, chitin, pectin), storage polysaccharides (starch, glycogen). Glycosaminoglycans, and Blood group substances. Galactomannans and their applications in modern foods.

**Unit – III: Lipids****(10 hrs.)**

Lipids: Classification, saturated and unsaturated fatty acids, structure and properties of fats and oils (acid, saponification and iodine values, rancidity). General properties of phospholipids.

Prostaglandins- structure, types, and biological role. Lipoproteins- types and functions. Biomembranes- Membrane composition and organization - Fluid mosaic model. Formation of micelles, bilayers, vesicles, liposomes.

**Unit IV: Amino Acids****(10hrs)**

Amino Acids: Classification, structure, chemical reactions of amino acids due to carboxyl and amino groups. Titration curve of Glycine, Essential and nonessential amino acids, non-protein amino acids. Peptide bond - nature and conformation. Naturally occurring peptides – glutathione, enkephalin.

**Unit V: Proteins:****(10hrs)**

Proteins: Classification based on solubility, shape, and function. Determination of the amino acid composition of proteins. General properties of proteins, denaturation, and renaturation of proteins. Structural organization of proteins- primary, secondary, tertiary, and quaternary structures (e.g., Haemoglobin and Myoglobin), forces stabilizing protein structures. Outlines of protein sequencing. Ramachandran -plot.

**Skill/Hands – on****(10hrs)**

Schematize the structures

**Co-curricular Activities**

- Class Test
- Quiz
- Assignment

**Prescribed Textbooks**

- Biochemistry 3<sup>rd</sup> Edition 2006 by Satyanarayana, Chakrapani.
- Outlines of Biochemistry, 5th Edition by E E Conn, PK Stumpf 693. John Wiley and Sons, New York. 1987
- Leininger Principles of Biochemistry SEVENTH EDITION David L. Nelson Madison Michael M. Cox

### **Reference Textbooks**

1. Proteins: A guide to study by physical & chemical methods, Haschemeyer and Haschemeyer,
2. Proteins: Structure, function, and evolution. Dickerson & Geis, 2nd Edn Benjamin/Cummings.
3. Fundamentals of Biochemistry by Donald Voet
4. Principles of Biochemistry White-A, Handler, Pand Smith E.L. Mc Grew Hill.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8**  
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**SYLLABUS**

**Subject: Biochemistry**

**Semester: I**

**Course Title: Qualitative Analysis-  
Practical**

**Course Code: 21BCP1QA12**

**No. of Hrs: 30**

**LTP: 002**

**Credits: 2**

**Objectives**

- To explain to the student about the Biosafety and good laboratory practices (GLP) to work in the laboratory,
- To impart the knowledge on the principles, procedure, and calculations
- To identify biomolecules by qualitative Tests
- To Understand Handling of pH meter. Weighing machine.

**Course Outcomes**

**CO1:** Gain of knowledge for preparing all the reagents, buffer, and solutions by themselves

**CO2:** Analysis of biological or non-biological sample biomolecules

**CO3:** Identification of biomolecules based on chemical reactions

**List of Practical**

1. Preparation of standard solutions by calculation of Normality, Molarity, and making dilutions.
2. Preparation of buffers (acidic, neutral, and alkaline), and determination of pH.
2. Qualitative Identification of carbohydrates - glucose, fructose, galactose ribose/xylose, maltose, sucrose, lactose, starch/glycogen.
3. Estimation of total sugars by Anthrone method.
4. Preparation of Osazones and their identification.
5. Qualitative identification of amino acids -histidine, tyrosine, tryptophan, cysteine, arginine.
- 6 . Qualitative Identification of lipids - solubility, saponification, Acrolein, Bromine test (Unsaturation), Salkowski test.
7. Isolation of DNA from tissue.
8. Estimation of RNA by Orcinol Method.

### **Prescribed Textbooks**

1. Experimental Biochemistry: A Student Companion by Beedu Sashidhar Rao, Vijay Deshpande.
2. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill. Practical Biochemistry – J. Jayaraman, 2nd Edition.
3. Biochemical calculations Seigel, IH, 2nd Edit, John Wiley & Sons Inc., 1983.

### **Reference Textbooks**

1. Principles and Techniques of Practical Biochemistry. Eds. Williams and Wilson.
2. Techniques in Molecular biology Ed. Walker & Gastra, Croom Helm, 1983.
3. Principles of instrumental analysis, 2nd Ed, Holt -Sanders, 1980.
4. An introduction to spectroscopy for Biochemistry. Ed. Brown S. N., Academic press.
5. Analytical Biochemistry, Holmes, and Hazel peck, Longman, 1983.
6. Biophysical chemistry, Edsall & Wyman, Academic press Vol. II & I.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA**  
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**SYLLABUS**

**Subject: Biochemistry**

**Semester: II**

**Course Title: Biophysical Techniques  
& Microbiological Methods**

**Course Code: 21BCCCBT23**

**No. of Hours: 60**

**LTP: 400**

**Credits: 3**

**Objectives**

- To Impart knowledge about the principles of biophysical instrumentation and microbial methods.
- To Incorporate theoretical and practical knowledge of principles and working of biophysical instrumentation.
- To know the usage of Instrumentation for analyzing/Separation of biochemically active compounds.

**Course outcomes**

At the end of the course, the student will be able to

**CO1:** Explain the different types and construction of different biophysical Instruments

**CO2:** Summarize the working principles of biophysical Instruments and microbiological methods

**CO3:** Describe different biophysical techniques and microbiological methods

**CO4:** Apply Biophysical techniques and Microbiological methods

**Unit - I: Cell homogenization and centrifugation (10 Hrs.)**

Introduction to types of Cells & Cell Lysis, methods of tissue homogenization: (Potter-Elvehjem, mechanical blender, sonication, and enzymatic). Centrifugation techniques, types, principles, and applications - differential, density gradient. Ultra-centrifugation - preparative and analytical.

**Unit - II: Chromatographic techniques (10 Hrs.)**

Types of chromatographic techniques, Principles, and applications - Paper chromatography - solvents, R<sub>f</sub> value, applications; Thin layer chromatography - principle, choice of adsorbent and solvent, R<sub>f</sub> value, applications. Gel filtration, Ion-exchange - principle, resins, the action of resins, experimental techniques, applications, separation of metal ions; Affinity chromatography. Introduction to HPLC.

**Unit - III Spectroscopy (10 Hrs.)**

Electromagnetic radiation, Introduction to Absorption & Emission spectroscopy Beer-Lambert's law.

Colorimetry, Spectrophotometry, spectrofluorimetry, and flame photometry.

**Unit - IV: Electrophoresis and tracer techniques (10 Hrs.)**

Electrophoresis - types of Electrophoresis principles and applications of paper, polyacrylamide (native and SDS), and agarose gel electrophoresis. Isoelectric focusing, immunoelectrophoresis -types, and applications. Tracer techniques: Radioisotopes, units of radioactivity, half-life,  $\beta$ , and  $\gamma$ - emitters, use of radioactive isotopes in biology.

**Unit - V: Microbiological Methods (10 Hrs.)**

Microscopy: Basic principles of light microscopy, phase contrast, fluorescent microscope and electron microscope their applications, isolation and culturing and preservation of microbes, Gram's staining (Gram-positive and Gram-negative bacteria), spore staining (Endospore staining), Hanging drop method (motility). Sterilization Techniques -Physical methods, chemical methods, Applications of Sterilization in the Food & Pharmaceutical Industry.

**Skill / Hands-on (10 Hrs.)**

- Schematize the Construction of different Biophysical Instruments
- Different separation techniques for analyzing and separating biologically active compounds
- Basic microbial Techniques -Sterilization techniques, medium preparation
- The basic method of bacterial Staining

**Co-curricular Activities:**

- Structure practicing sessions
- Class Tests
- Quiz
- Assignment

**Prescribed Text Books**

1. Textbook of Biophysical Chemistry – Nath & Upadhyaya., Himalaya publications
2. Outlines of Biochemistry, 5th Edition by E E Conn, PK Stumpf 693. John Wiley and Sons, New York. 1987
3. Biochemistry Prof. U. Satyanarayana, 3rd revised Edition:2006, Arunabha Sen, books and allied (P)Ltd, 8/1Chintamani Das lane, Kolkata 700009.

**Reference Text Books**

1. Biochemistry by L. Steyer (1995) W. H. Freeman Press, San Francisco, USA. 4.
2. Biochemistry, by Voet. D. and Voet, J. G. (2004). 3rd Edition, John Wiley & Sons, Inc. USA.
3. Leininger Principles of Biochemistry SEVENTH EDITION David L. Nelson Madison Michael M. Cox.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA**  
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**SYLLABUS**

**Subject: Biochemistry**

**Semester: II**

**Course Title: Biophysical Techniques-Practical**

**Course Code: 21BCP2BT22**

**No. of Hrs:30**

**LTP: 002**

**Credits:2**

**Course objectives**

- To explain to the student about Biosafety and good laboratory practices (GLP) to handle instrumentation.
- To impart knowledge on the principles, and handling of Instruments
- To identify biologically relevant components

**Course outcomes**

**CO1:** Analyse the biomolecules using analytical techniques

**CO2:** Test the biologically relevant samples by isolation techniques and identification methods

**CO3:** Evaluate biological relevant samples

**List of Experiments:**

1. Separation of amino acids by circular paper chromatography.
2. Separation of plant pigments by TLC
3. Separation of serum proteins by paper electrophoresis.
4. Isolation of casein from milk.
5. To verify Lambert – beer 's law for KMnO<sub>4</sub> colorimetrically.
6. Absorption spectra of nucleic acids- DNA using spectrophotometer
7. Gram Staining Procedure
8. Hanging Drop method

**Prescribed Textbooks**

1. Experimental Biochemistry: A Student Companion by Beedu Sashidhar Rao, Vijay Deshpande.
2. An Introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill. Practical Biochemistry – J. Jayaraman, 2nd Edition.
3. Biochemical calculations Seigel, IH, 2nd Edit, John Wiley & Sons Inc., 1983.



### **Reference Textbooks**

1. Principles and Techniques of Practical Biochemistry. Eds. Williams and Wilson.
2. Techniques in Molecular biology Ed. Walker & Gastra, Croom Helm, 1983.
3. Principles of Instrumental analysis, 2nd Ed, Holt-Sanders, 1980.
4. An introduction to spectroscopy for Biochemistry. Ed. Brown S.N., Academic press.
5. Analytical Biochemistry, Holmes, and Hazel peck, Longman, 1983.
6. Biophysical chemistry, Edsall & Wyman, Academic press Vol. II & I.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8**  
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**SYLLABUS**

<b>Subject: Biochemistry</b>	<b>Semester: III</b>	
<b>Course Title: Enzymology</b>	<b>Course Code: 20BCCCIM33</b>	
<b>&amp; Intermediary Metabolism</b>		
<b>No. of Hrs: 60</b>	<b>LTP:400</b>	<b>Credits:3</b>

**Course objectives**

- To understand the concepts of enzymes and enzyme-substrate reactions.
- To impart basic knowledge about the bioenergetics and energy transformations of living organisms.
- To provide information on metabolic processes undergone by the biomolecules
- To emphasize the importance of the metabolism of biological systems

**Course outcomes:**

**CO1:** Explain the physiological importance of enzymes and their role in metabolism

**CO2:** Summarize the concepts of thermodynamics and energy transformations in metabolism.

**CO3:** Outline the metabolism of different biomolecules.

**CO4:** Explain the pathophysiology of metabolic diseases

**Unit-I: Enzymology (10 hrs.)**

Introduction to Biocatalysts, differences between chemical and biological catalysis. Nomenclature and classification of enzymes. Fundamentals of enzyme assays, enzyme units. Definition- holoenzyme, apoenzyme, cofactors, active site, enzyme specificity. Activation energy, transition state theory. Outlines of the mechanism of enzyme action - Interaction between enzyme and substrate-lock and key and induced fit models. Michaelis -Menten equation, Significance of  $K_m$  and  $V_{max}$  Enzyme inhibition (Reversible and Irreversible). Factors affecting enzyme activity (temperature, pH, enzyme. and substrate concentration). Commercial application of enzymes.

**Unit- II: Bioenergetics and Biological oxidation (10 hrs.)**

Bioenergetics: Thermodynamic principles – Chemical equilibrium; free energy, enthalpy (H), entropy (S). Free energy change in biological transformations in living systems; High energy compounds -ATP. Organization of electron transport Chain. Oxidative phosphorylation- inhibitors of oxidative phosphorylation.

**Unit-III: Carbohydrate Metabolism (10 hrs.)**

Overview of metabolism- Glycolytic pathway, anaplerotic reactions of Citric Acid Cycle. Pentose Phosphate Pathway, Glycogenolysis, and glycogenesis, Gluconeogenesis with energy yields. Disorders of carbohydrate metabolism- Diabetes Mellitus. Photosynthesis- Light and Dark reactions.

**Unit-IV: Amino acid and Lipid Metabolism (10 hrs.)**

General reactions of amino acid metabolism- transamination, decarboxylation and deamination, Biosynthesis of creatine. Disorders of aromatic and branched-chain amino acid metabolism, phenylketonuria, maple syrup urine disease.  $\beta$ - oxidation of fatty acids, Biosynthesis of triacylglycerol, disorders of lipid metabolism- Gaucher disease.

**Unit-V: Metabolism of Nucleic acid and porphyrin (10 hrs.)**

Biosynthesis and regulation of purine and pyrimidine nucleotides - De novo synthesis, Catabolism of purines and pyrimidines, Haem biosynthesis degradation, Disorders of nucleotide and porphyrin metabolism- Gout, and porphyria.

**Skill / Hands-on (5hrs.)**

- Schematize the metabolic reactions
- Calculation of Energy transformations
- Connecting different metabolisms to the TCA cycle

**Co-curricular Activities: (5hrs.)**

- Metabolic reaction structures practicing sessions
- Assignments on metabolic disorders
- Drawing chart for whole Intermediary metabolism

### **Prescribed Textbooks**

1. Biochemistry 3<sup>rd</sup> Edition 2006 by Satyanarayana, Chakrapani 4<sup>th</sup> revised Edition
2. Biochemistry (2012) 7<sup>th</sup> ed., Berg, J.M., Tymoczko, J.L., and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936
3. Lehninger: Principles of Biochemistry (2013) 6<sup>th</sup> ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13:978-1-4641-0962-The biochemistry of Nucleic acids; Adams et al., Chapman and Hall, 1986.
4. Outlines of Biochemistry, 5<sup>th</sup> Edition by E E Conn, PK Stumpf 693. John Wiley and Sons, New York. 1987

### **Reference text Books**

1. Textbook of Biochemistry with Clinical Correlations (2011) 7<sup>th</sup> ed., Devlin, T.M., John Wiley & Sons, Inc. (New Jersey), ISBN:978-0-470-28173-4.
2. Biochemistry, A problem Approach, 2<sup>nd</sup> Edn. Wood, W.B. Addison Wesley 1981.
3. Principles of Biochemistry White-A, Handler, Pand Smith E.L. Mc Graw Hill.

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**SYLLABUS**

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<b>Subject: Biochemistry</b>	<b>Semester: III</b>
<b>Course Title: Enzymology-Practical</b>	<b>Course Code: 20BCP3EN32</b>
<b>No. of hours: 30</b>	<b>LTP 002 Credits: 2</b>

**Course objectives**

- Learn the various Enzymes assays
- Quantitation of biologically important parameters.

**Course outcomes**

After completion of the practical, students will be able to

CO1: perform assays for different enzymes

CO2: Examine the different biologically important parameters.

1. Assay of amylase.
2. Assay of urease.
3. Assay of catalase
4. Effect of pH, the temperature on enzyme activity.
5. Effect substrate concentration on enzyme activity.
6. Estimation of Haemoglobin by Cyanmethemoglobin method.
7. Estimation of Urea by Diacetyl Monoxime (DAM) Method
8. Estimation of Blood Glucose by DNS method.

**Prescribed Textbook**

1. Experimental Biochemistry: A Student Companion by Beedu Sashidhar Rao, Vijay Deshpande.
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hoffman and Samuel Cloekie.
3. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew-Hill.

**Reference Textbook**

1. Analytical Biochemistry, Holmes, and Hazel peck, Longman, 1983.
2. A textbook of quantitative inorganic analysis including elementary instrumental analysis, Vogel ELBS.

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**SYLLABUS**

<b>Subject: Biochemistry</b>	<b>Semester: IV</b>	
<b>Course Title: Physiology, Nutrition &amp; Clinical Biochemistry</b>	<b>Course Code: 20BCCCCB43</b>	
<b>No. of Hours: 60</b>	<b>LTP: 400</b>	<b>Credits: 3</b>

**Objectives**

- To understand the concepts of Physiological systems
- To acquire basic knowledge about the serological tests
- To impart knowledge of nutritional requirements
- To emphasize the importance of the Hormones of biological systems.

**Course Outcomes**

**CO1:** Describe different components of blood, and different Physiological systems

**CO2:** Classify the Physiological systems and Hormones based on functions

**CO3:** Explain the details of nutrient requirements for functioning of various physiological systems

**CO4:** Understand the pathophysiology of different organs in health and disease

**UNIT – I: Digestion and Blood (10 Hrs.)**

Digestion and absorption of carbohydrates, lipids, and proteins. Role of enzymes and gastrointestinal hormones in digestion.

Composition of the blood, Blood groups, coagulation of blood, and disorders of blood coagulation (haemophilia). Haemoglobin and transport of gases in the blood (oxygen and CO<sub>2</sub>). Types of anaemias, hemoglobinopathies - sickle cell anaemia.

**UNIT – II: Excretory System and Musculoskeletal System (10 Hrs.)**

Muscles - types of muscles, Organization, of the skeletal system, Structure of bone, and mechanism of muscle contraction.

Introduction to excretory system Organization of kidney, Structure, and functions of the nephron, Urine formation, Role of kidneys in maintaining acid-base and electrolyte balance in the body.

**UNIT - III: Nervous System and Endocrinology (10 Hrs.)**

Introduction to the nervous system, the general organization of a nervous system, Neurons -structure, types, properties and functions; Neurotransmitters, Reflex -types, Endocrinology - organization of the endocrine system. Classification of hormones. Outlines of chemistry, physiological role, and disorders of hormones of, pituitary, hypothalamus. thyroid, parathyroid, and Introduction of gastrointestinal hormones. Mechanism of hormonal action (outlines).

**UNIT - IV: Nutritional Biochemistry (10 Hrs.)**

Balanced diet. Calorific values of foods and their determination by bomb calorimeter. BMR and factors affecting it. The specific dynamic action of foods. Energy requirements, Sources of complete and incomplete proteins. The biological value of proteins. Malnutrition - Kwashiorkor, Marasmus, and PEM. Vitamins - sources, structure, biochemical roles, deficiency disorders of water - and fat -soluble vitamins. Introduction to nutraceuticals and functional foods. Bulk and trace elements -Ca, Mg, Fe, I, Cu, Mo, Zn, Se, and F.

**UNIT – V: Clinical Biochemistry (10 Hrs.)**

Plasma proteins in health and disease. Serum lipids and lipoproteins. Liver function tests - conjugated and total bilirubin in serum, albumin: globulin ratio, Serum enzymes in liver diseases -SGOT, SGPT, GGT, CPK, Acid, and alkaline phosphatases. Normal and abnormal constituents of urine. Renal function tests -Blood urea, creatinine, GFR, creatinine clearance. GTT and gastric and pancreatic function tests.

**Skill / Hands - on (12 Hrs.)**

1. Schematize the metabolic reactions
2. Identification of biologically relevant metabolites
3. Calculation of Energy transformations
4. Connecting different metabolisms to TCA cycle

**Co-curricular Activities**

1. Schematic models of different Physiological Systems
2. Assignments
3. Schematic representations through Charts

### **Prescribed Books**

1. Biochemistry 3<sup>rd</sup> Edition 2006 by Satyanarayana, Chakrapani 3rd revised.
2. Essentials of Food and Nutrition, Vol. I & II, M.S. Swaminathan.
3. Text Book of Biochemistry with clinical correlations. Thomas M. Devlin (John Wiley).
4. Harper's Review of Biochemistry, Murray et al (Longman).
5. Biochemical aspects of human disease – R.S. Elkeles and A.S. Tavit. (Blackwell Scientific Publications).
6. Human Physiology by Chaterjee and Chatterjee

### **Reference Books**

1. Guyton and Hall Textbook of Medical Physiology.
2. Clinical Biochemistry – S. Ramakrishnan and Rajiswami.
3. Chemical Biochemistry (Metabolic and clinical aspects) by W.J.Marshall & S.K .Bangert.
4. Textbook of clinical Biochemistry by Tietz et al.



**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA – 8**  
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**SYLLABUS**

**Subject: Biochemistry**

**Semester: IV**

**Course Title: Clinical Biochemistry – Practical**

**Course Code: 20BCP4CB42**

**No. of Hours: 30**

**LTP: 002**

**Credits: 2**

**Objectives**

- To Learn LFT, RFT, and determination of biological components
- perform biochemical tests,

**Course Outcomes**

**CO1:** Diagnose and monitor diseased conditions

**CO2:** Examine to compare the normal versus diseased condition

**List of Experiments**

1. Determination of vitamin C by 2, 6 -dichlorophenol indophenol method.
2. Estimation of iron by Wong 's method.
3. Urine Analysis of albumin, sugars, and ketone bodies
4. Estimation of Serum Albumin-Globulin ratio
5. Estimation of serum bilirubin
6. Estimation of SGOT(AST), SGPT(ALT), GGT
7. Estimation of Serum/Urinary Creatinine
8. Determination of Serum Inorganic Phosphorus (Fiske and SubbaRow method)

**Prescribed Textbooks**

1. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London, 1988).
2. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew -Hill.

**Reference Book**

1. Clinical diagnosis and management by Lab methods (John Bernard Henry, W. B. Saunders Company, 1984).

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**SYLLABUS**

<b>Subject: Biochemistry</b>	<b>Semester: IV</b>	
<b>Course Title: Microbiology, Immunology &amp; Molecular Biology</b>	<b>Course Code: 20BCCCMB43</b>	
<b>No. of Hours: 60</b>	<b>LTP:400</b>	<b>Credits:3</b>

**Objectives**

- To understand the concepts of different interdisciplinary fields
- To acquire basic knowledge about the Molecular Biology
- To impart knowledge of Immunology
- To provide information on Microbiology
- To emphasize the importance of other applied fields biochemistry

**Course Outcomes**

**CO1:** Outline the different interdisciplinary fields

**CO2:** Identify the microorganisms involved in different biological processes

**CO3:** Explain the biological processes

**CO4:** Understand the different organisms and biological processes

**UNIT – I: Microbiology** **(10 Hrs.)**

Introduction to microbiology, Introduction to Bergey's Manual of Systematic Bacteriology, Bacterial structure: Cell wall, cell membrane, Flagella, Fimbriae, nucleoid region, growth curve.

Introduction to viruses, plant viruses: Tobacco mosaic virus (TMV), Tomato spotted wilt virus (TSWV), and animal viruses: Retroviruses structure, life cycle (Lytic and Lysogenic)

**UNIT – II: Nitrogen Fixation** **(10 Hrs.)**

The Nitrogen cycle, non -biological and biological nitrogen fixation, photosynthesis - pigments, Photosystems: I & II, mechanism Nitrogenase system.

Utilization of nitrate ion, Ammonia incorporation into organic compounds.

Synthesis of glutamine and regulatory mechanism of glutamine synthase.

**UNIT – III: Applied Biochemistry** (10 Hrs.)

Fermentation Technology: Batch, continuous culture techniques, principle, types of fermenters. Pasteur effect. Industrial production of chemicals - alcohol, acids (citric acid), solvents (acetone), antibiotics (penicillin)

Enzyme Technology: Immobilization of enzymes and cells, industrial applications, enzymes in Bioremediation.

**UNIT – IV: Immunology** (10 Hrs.)

Organs and cells of the immune system. Innate and acquired immunity, Cell-mediated and humoral immunity (T-cells and B-cells). Immunoglobulins, the structure of Ig G . and Epitopes / antigenic determinants. haptens. Adjuvants.

Monoclonal antibodies. Antigen-antibody reactions - Precipitations, agglutination, Complement Fixation. Blood group antigens. Immunodiagnostics - ELISA. Vaccines and their classification: Traditional vaccines live attenuated, dead, modern vaccines - recombinant and peptide vaccines. Outlines of hypersensitivity reactions.

**Unit- V: Molecular biology** (10 Hrs.)

DNA replication, transcription, and repair leading and lagging strands, Okazaki fragments, inhibitors of DNA replication.

Protein synthesis - Genetic code, translation, inhibitors of protein synthesis.

Outlines of cloning technology, plasmids, vectors, restriction enzymes, PCR, applications of cloning in agriculture, industry, and medical fields.

**Skill / Hands on** (10 Hrs.)

1. Memorize the Genetic code of all 20 amino acids
2. Identification of the genetic basis of a particular blood group
3. Immobilization techniques of cell and Enzymes
4. Charts showing Connecting the lysogenic and lytic cycles of viral replication

**Co-curricular Activities**

1. Schematic models of DNA replication, protein synthesis process
2. Assignments
3. Schematic representations through Charts

### **Prescribed Textbooks**

1. Willey MJ, Sherwood, LM & Woolverton C J (2013) Prescott, Harley and Klein's Microbiology by. 9th Ed., McGrawHill.
2. Atlas RM. (1997). Principles of Microbiology. 2nd edition. WM.T.Brown Publishers.
3. Pelczar MJ, Chan ECS and Krieg NR. (1993). Microbiology. 5th edition. McGraw Hill Book Company.
4. Fermentation Technology (2nd ed.) Standury (Pergman press)
5. Molecular biology by David Freifelder

### **Reference Textbooks**

1. Biotechnology: Textbook of Industrial microbiology 2nd Edit. By Crueger and Crueger (2000).
2. Principles of Biochemistry, White. A, Handler, P and Smith.
3. Goldsby RA, Kindt TJ, Osborne BA. (2007). Kuby's Immunology. 6th edition
4. W.H. Freeman and Company, New York.
5. Molecular Biology of the Gene, 6th edition, Cold Spring Harbour Lab. Press, Pearson.

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**SYLLABUS**

**Subject: Biochemistry**

**Semester: IV**

**Course Title: Applied Biochemistry – Practical**

**Course Code: 20BCP5AB42**

**No. of Hours: 30**

**LTP: 002**

**Credits: 2**

**Course Objectives**

- To Learn basic applied biochemical Techniques
- To Enhance Knowledge of Immunochemical Techniques
- To Impart knowledge on the sensitivity of organisms to various antibiotics

**Course Outcomes**

**CO1:** Analyse biological samples

**CO2:** Understand the different biological processes

**List of Practical**

1. Demonstration of amylase production
2. Antibiotic sensitivity by paper disc method.
3. Immobilization of enzyme and testing its activity
4. Single radial Immunodiffusion Assay -Mancini method
5. ABO Blood grouping
6. Isolation of plasmid from bacteria
7. Demonstration of PCR reaction in a thermal cycler.
8. Spotters.

**Prescribed Textbooks**

1. Varley's Practical Clinical Biochemistry – Ed. Alan W. Gowenlock (Heinemann Medical Books, London, 1988).
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Andreas Hoffman and Samuel Cloekie.
3. An introduction to practical biochemistry. David T. Plummer, Tata Mac Grew -Hill.

**Reference Books**

1. Clinical diagnosis and management by Lab methods (John Bernard Henry, W.B. Salunders Company, 1984).

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**SYLLABUS**

**Subject: Biochemistry**

**Semester: V/VI**

**Course Title: Forensic Biochemistry**

**Course Code: 20BCSEC11FB3**

**No. of Hours: 45**

**Credits: 3**

**LTP:300**

**Objectives**

- To impart basic knowledge and skills on Biochemical forensic investigation methods.
- To promote critical thinking.
- To understand the importance of probabilistic reasoning.

**Course Outcomes**

**CO1:** Understand the underlying principles of DNA for use in forensic studies

**CO2:** Develop scientific temper on DNA

**CO3:** Analyse and evaluate forensic problems using biochemical methods

**CO4:** Identify and suggest means for forensic problems

**Unit I Introduction**

**(9 Hrs.)**

Basic principles and their significance. Branches of forensic Science. History & development of Forensic science. Nature and scope of forensic science. The organizational structure of Forensic Science Laboratories at the central & State level. Ethics in Forensic science.

**Unit II DNA Biology**

**(9 Hrs.)**

Principles of DNA structure - DNA in the cell, Organisation of Information in the cell, Identification of DNA information, DNA variation (SNP), Short Tandem Repeat (STR) Markers, Position of Forensic STR Markers on Human Chromosomes, paternity testing, DNA evidence.

**Unit III      DNA technology in Forensic Science      (9 Hrs.)**

Introduction, individual Variation in DNA, DNA Typing- Genetic basis of DNA typing structure and function of DNA, technological basis of DNA typing - Restriction Fragment Length Polymorphisms, PCR-based typing methods such as RAPD, AFLP, STR.

**Unit IV      Forensic Biochemical Analysis      (9 Hrs.)**

Enzymes used in Forensic Science -Restriction enzymes, Phosphatases, DNA polymerases, and DNA ligases, and their forensic significance, Forensic Serology – Blood, Saliva, Urine, Bone, Teeth, Hair, and other body fluids. Forensic Immunology – ELISA, blood group-specific ABH substances.

**Unit V      Techniques used in Biochemical Investigation      (9 Hrs.)**

Use of Thin-layer chromatography -TLC, Gas Chromatography (GC), High-Performance Liquid Chromatography (HPLC), Ultraviolet and visible spectrophotometer, and Immunoassay in Forensic analysis.

**Co-Curricular Activities**

1. Assignments.
2. Chart preparations.
3. Group discussions on case studies.
4. Student seminars.

**Prescribed Text Books**

1. Essential Forensic Biology, Second Edition, Alan Gunn, Wiley-Blackwell, 2009.
2. Ethics in Forensic Science: Professional Standards for the Practice of Criminalistics by Peter D. Barnett.
3. The Biological Evidence Preservation Handbook: Best Practices for Evidence Handlers. Susan Ballou Mark Stolorow Melissa Taylor.

**Reference Text Books**

1. Nelson, D. L. & Cox, M. M. Lehninger Principles of Biochemistry. Freeman, 5<sup>th</sup> ed, 2008.
2. Principles of Forensic Medicine and Toxicology by Rajesh Bardale.

**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8**  
**(Affiliated to Krishna University, Machilipatnam)**

**SYLLABUS**

**Subject: Biochemistry**

**Semester: V/VI**

**Course Title: Forensic Biochemistry-Practical**

**Course Code: 20BCP611FB2**

**No. of Hours: 45 Hrs.**

**LTP: 003**

**Credits: 2**

**Objectives**

- To teach the basic techniques for analysis of evidence.
- To demonstrate DNA profiling techniques.

**Course Outcomes**

**CO1:** Apply the different types of techniques that make use of DNA for analysing Forensic sample

**CO2:** Analysis of sample found as evidence.

**List of Practical**

**(30 Hrs.)**

1. Extraction and purification of DNA from various samples - Hair, Saliva, dried blood samples.
2. Analysis of DNA sample – RFLP.
3. Demonstration of DNA Amplification technique – AFLP.
4. Determination of Blood group substances in body fluids.
5. Developing of Latent Fingerprints.

**Skill/Hands-on: Field Work/Mini Project**

**(15 Hrs.)**

1. Training students by industrial/technical experts.
2. Identification of different analysis instruments, their handling, and operational techniques with safety and security.
3. Visit nearby Forensic laboratories or research organizations, private firms, etc.

**Prescribed Textbooks**

1. Molecular cloning: A laboratory manual, 2nd edition: by J. Sambrook, EF Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, 1989.
3. Practical Immunology, Fourth Edition Frank C. Hay Ph.D., Olwyn M.R. Westwood Ph.D.,



**MARIS STELLA COLLEGE (AUTONOMOUS), VIJAYAWADA-8**  
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**SYLLABUS**

**Subject: Biochemistry**  
**Course Title: Bioinformatics**  
**No. of Hours: 45**

**LTP:300**

**Semester: V/VI**  
**Course Code: 20BCSEC12BI3**  
**Credits: 3**

**Objectives**

- To Impart knowledge of Bioinformatics methods.
- To correlate theoretical and practical knowledge on principles and applications of Bioinformatics Tools.

**Course Outcomes**

**CO1:** Understand the importance of Bioinformatics in Research.

**CO2:** Acquire knowledge to retrieve data from the available databases.

**CO3:** Analyse the data by using bioinformatic tools.

**CO4:** Skills to collect, process, and obtain biological information.

**Unit-I Bioinformatics**

**(9 Hrs.)**

Bioinformatics – Fundamentals, Historical Background, Introduction, Importance, programming languages in Bioinformatics Scope -Genomics, Proteomics, and Drug Designing, Applications of Bioinformatics – Medicine, Drug discovery, Veterinary Science, Crop improvement Gene Therapy, evolutionary studies, and Biotechnology.

**Unit II Biological databases and Data retrieval**

**(9 Hrs.)**

Introduction to biological database- Primary, Secondary and composite database, Nucleic acid database - NCBI, EMBL.DDBJ), Protein database -PDB, Swiss-Prot, TrEMBL, Metabolic pathway database – KEGG pathway, MetaCyc .

**Unit III Sequence Alignment Tools**

**(9 Hrs.)**

Molecular Sequence Alignment Tools - Local and Global Alignment, Pairwise and multiple sequence alignment, BLAST (Basic Local Alignment Search Tool).

**Unit IV      Bioinformatics Tools      (9 Hrs.)**

Genscan, Expasy, Codon plot, FASTA, Online PCR, Primer- 3 and, Gene Cards,

**Unit V      Phylogenetic Analysis      (9 Hrs.)**

Phylogenetic tree, History, Purposes of the phylogenetic tree, Parts of a phylogenetic tree, Types of a phylogenetic tree, Phylogenetic tree construction, Applications of phylogenetic tree • Construction of phylogenetic tree – CLUSTALW.

**Co-Curricular Activities**

1. Assignments.
2. Chart preparations on KEGG pathways.
3. Group discussions on analysis of data.
4. Student seminars.

**Prescribed Textbooks**

1. Essential Bioinformatics Jin Xiong, Cambridge University Press.
2. Bioinformatics Methods and Applications: Genomics Proteomics And Drug Discovery 3Rd Ed. Authors, S. C. Rastogi, Parag Rastogi, Namita Mendiratta.
3. Bioinformatics Basics: Applications in Biological Science and Medicine. Hooman H. Rashidi, Lukas K. Buehler CRC Press/Taylor & Francis Group.

**Reference Textbooks**

1. Lesk MA. (2002) Introduction to Bioinformatics. Oxford University Press.
2. Bioinformatics for Dummies, 2<sup>nd</sup> Edition, Jean Michel Claverie, Cedric Notredame. Wiley Publishing Inc.

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**SYLLABUS**

<b>Subject: Biochemistry</b>	<b>Semester: V/VI</b>	
<b>Course Title: Bioinformatics – Practical</b>	<b>Course Code: 20BCP712BI2</b>	
<b>No. of Hours: 45</b>	<b>LTP: 003</b>	<b>Credits: 2</b>

**Objectives**

- To Impart knowledge practical use of Bioinformatics methods.
- To Apply principles of theoretical knowledge of Bioinformatics Tools in practical.

**Course Outcomes**

**CO1:** Make use of skills to Retrieve, identify and align the sequences for research purpose

**CO2:** Align and Construct Phylogenetic tree from the given sequences to identify related and unrelated species

**List of Practical** (30 Hrs.)

1. Exploration of the resources available in NCBI – Genbank entry, FASTA
2. Biological Database searching with heuristic algorithm: BLAST.
3. Retrieval and analysis of a sequence from database
4. Pair-wise and multiple sequence alignment and creating a Phylogenetic tree
5. Conversion of nucleotide sequence into its protein sequence and vice-versa.

**Skill/Hands-on: Fieldwork/Mini Project** (15 Hrs.)

1. Training students by mini-Projects.
2. Identification of different analysis software.
3. Visit nearby Bioinformatics laboratories or research organizations, private firms, etc.

**Prescribed Text Books**

1. Essential Bioinformatics Jin Xiong, Cambridge University Press.
2. Bioinformatics Methods and Applications: Genomics Proteomics And Drug Discovery 3Rd Ed. Authors, S. C. Rastogi, Parag Rastogi, Namita Mendiratta.
3. Bioinformatics Basics: Applications in Biological Science and Medicine. Hooman H. Rashidi, Lukas K. Buehler CRC Press/Taylor & Francis Group.

**Reference Text Books**

1. Lesk MA. (2002) Introduction to Bioinformatics. Oxford University Press.
2. Bioinformatics for Dummies, 2<sup>nd</sup> Edition, Jean Michel Claverie, Cedric Notredame. Wiley Publishing Inc.



**Unit III      Data Collection and Analysis Tools      (9 Hrs.)**

Preparations before conducting research, Methods of data collection - Interviews, Questionnaires and surveys, Observations. Documents and records, Focus groups, Oral histories, Analysis Methods-Review of hypothesis testing procedures, Factor analysis, Cluster analysis, and Introduction to Statistical analysis packages available: Microsoft Excel.

**Unit IV      Writing Research      (9 Hrs.)**

Types of research documents, writing and formatting of report, presentation, interpretation, art of oral presentation, format of publications in research journals; Journal Impact factor, h-index, and i-10 Index.

**Unit V      Research Ethics and IPR      (9 Hrs.)**

Ethics-ethical issues, ethical committees; IPR- intellectual property rights and patent laws, copyrights, trademarks.

**Co-Curricular Activities**

1. Assignments.
2. Designing a study.
3. Formulation of Questionnaire.
4. Student seminars.

**Prescribed Text Books**

1. Cooper D R, Schindler P S and Sharma J K (2012); Business Research Methods, McGraw Hill Education.
2. Bryman and Bell; Business Research Methods, Oxford University Press
3. Malhotra, Naresh (2007); Market Research, Prentice Hall of India.

**Reference Text Books**

1. Panneerselvam R(2006); Research Methodology, Prentice Hall of India.
2. Garg, B.L., Kapadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology.
3. Satarkar, S.V., 2000. Intellectual property rights and Copyright. Ess Ess Publications.

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**SYLLABUS**

<b>Subject: Biochemistry</b>	<b>Semester: V/VI</b>
<b>Course Title: Research Methodology - Practical</b>	<b>Course Code: 20BCP621RM2</b>
<b>No. of Hours: 45</b>	<b>LTP: 003</b>
	<b>Credits: 2</b>

**Objectives**

- To apply theoretical knowledge in practice.
- To gain basic knowledge on project writing and presentation of the proposal.

**Course Outcomes**

**CO1:** Evaluate hypothesis through testing.

**CO2:** Compute, document, analyse and summarize their findings.

**List of Practical**

**(30 Hrs.)**

1. Design a Questionnaire for Survey on a particular research topic.
2. Formulation of hypothesis.
3. Writing a Project Proposal.
4. Identify and rectify common problems encountered when preparing the Research Report.
5. Presentation of Research Project proposal.

**Skill/Hands-on: Field Work/Mini Project**

**(15 Hrs.)**

1. Training students by experts.
2. Identification of Research problem.
3. Dealing with ethical challenges.

**Prescribed Book**

1. Research Methods: A Practical Guide for Students and Researchers by Willie Tan.

**2. Reference Book**

Research Methodology: A Practical and Scientific Approach by Vinayak Bairagi

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**SYLLABUS**

**Subject: Biochemistry**

**Semester: V/VI**

**Course Title: Biostatistics**

**Course Code: 20BCSEC22BS3**

**No. of Hours:45**

**LTP:300**

**Credits: 3**

**Objectives**

- To explain the basic concepts of biostatistics
- To impart knowledge about the concept of hypothesis testing to make a statistical decision
- To enable express their knowledge from a scientific point of view

**Course Outcomes**

**CO1:** Apply the principles of biological data management in real-life situations.

**CO2:** Correlate with the other sciences.

**CO3:** Understand the nature of variability

**CO4:** Define some hypothesis testing concepts.

**Unit I: Introduction to Biostatistics (9 Hrs.)**

Introduction, and terms used in biostatistics, Importance of biostatistics in biological science. statistical analysis methods -Mean, Standard Deviation, Regression, Hypothesis Testing, Sample Size Determination.

**Unit II: Sampling techniques (9 Hrs.)**

Introduction, sample vs population, types of sampling - Simple Random Sampling, Stratified Random Sampling, Convenience Sampling Quota Sampling, sample size, sampling error, Evaluating information from sample.

**Unit III Regression**

Introduction, types, Introduction to regression analysis and its use. Parametric tests (z-test, t-test, and F-test) and non-parametric tests (Chi-square test, One-way, and two-way ANOVA)

#### **Unit IV      Correlation**

Introduction, types, Concept of Pearson Correlation, statistical significance. Interpretation of correlation and Regression. - bivariate and multivariate Multivariate Techniques:

#### **Unit V      Application of statistical methods**

In different fields of Biology, Pharmaceutical sciences, medicine, agriculture, and nutrition. healthcare genetics

#### **Prescribed Text Books**

1. Biostatistics: Concepts and Applications for Biologists, 2015, Brian Grad Williams.
2. Banerjee PK. Introduction to Biostatistics. S. Chand.
3. Rashidi H, Buehler KL. (2005)
4. Principles of Biostatistics, M. Pagano and K. Gauvreau (2000); Duxbury Thomas learnings.
5. Analysis of Biological Data, M. Whitlock and D. Schluter (2009); Roberts and company publishers.



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**SYLLABUS**

**Subject: Biochemistry**

**Semester: V/VI**

**Course Title: Biostatistics - Practical**

**Course Code: 20BCP722BS2**

**No. of Hours: 45**

**LTP: 003**

**Credits: 2**

**Objectives**

- To impart knowledge, make sense of all of that available data.
- To learn basic statistical calculations.

**Course Outcomes**

**CO1:** Deriving general laws from small samples.

**CO2:** Identify data relating to variable/variables.

**List of Practical**

**(30 Hrs.)**

1. Calculation of Mean, Median, Mode and Standard deviation
2. Construction of Bar, line, Pie diagram and Histogram
3. Problems on Hypothesis testing - Z-test, t -test, Chi-square test
4. Analysis of data by non-parametric tests
5. One-way ANOVA test.

**Skill/Hands-on: Field Work/Mini Project**

**(15 Hrs.)**

1. Training students by industrial/technical experts. Identification of different analysis instruments, their handling, and operational techniques with safety and security.
2. Visit nearby Biostatistics organizations and private firms.

**Reference Text Books**

1. Principles of Biostatistics, M. Pagano and K. Gauvreau (2000); Duxbury Thomas learnings.
2. Analysis of Biological Data, M. Whitlock and D. Schluter (2009); Roberts and company publishers.

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**SYLLABUS**

<b>Subject: Biochemistry</b>	<b>Semester: V</b>
<b>Course Title: Diagnostic Biochemistry</b>	<b>Course Code: 20BCSEC31DB3</b>
<b>No. of Hours:45</b>	<b>LTP:300</b>
	<b>Credits: 3</b>

**Objectives**

- To equip students with adequate technical skills in Biochemical diagnosis
- To impart knowledge on the procedures of Clinical and diagnostic laboratories.

**Course Outcomes**

**CO1:** Acquire knowledge on the principles of biochemical diagnostic tests

**CO2:** Understand their use in assessing health condition

**CO3:** Analysis of samples using biochemical tests.

**CO4:** Utilize different techniques to draw improved inferences.

**Unit I        Lab Safety and Hazards**

Elementary Knowledge of Clinical Laboratory Safety and Laboratory hazards. Ethics, accuracy, and Precision: Factors affecting the accuracy of results, Good Laboratory Practices.

**Unit II:        Sampling Techniques**

Clinical Sampling, Specimen handling, transport, preservation, and disposal. Collection of biological fluids: Blood, urine, and cerebrospinal fluid. Reference Range. Quality control and Quality assurance.

**Unit III:        Biochemical Markers**

Cardiac biomarkers -Troponins, Markers of Altered Thyroid Status - low-density lipoprotein (LDL) cholesterol reading, biochemical markers of bone BAP, turnover, inflammatory markers -IL-6, Insulin resistance (IR) markers - TG/HDL.

#### **Unit IV: Immunological tests**

Immunodiffusion techniques - Single diffusion in one dimension (Oudin procedure)  
Double diffusion in one dimension (Oakley Fulthorpe procedure). Immunoglobulin testing & Immunoelectrophoresis -serum test. Radioimmunoassays, Immunofluorescence assays, Immuno-enzyme Assays (EIA).

#### **Unit V Serological Tests**

HLA (human leukocyte antigens) typing, Precipitation Tests -Ring test, Flocculation tests, neutralization tests, hemagglutination- inhibition tests, and chemiluminescence immunoassays.

#### **Skill/Hands-on: Fieldwork/Mini Project**

**(15 Hrs.)**

- Training students by industrial/technical experts.
- Identification of different analysis instruments, their handling, and operational techniques with safety and security.
- Visit nearby Diagnostic Labs

#### **Prescribed Textbooks**

1. Practical Clinical Biochemistry; Author, **Harold Varley**; Edition, 4; Publisher, Heinemann Medical.
2. A Quick Guide to Clinical Biochemistry, Buthaina Al-Balushi, Mohamed Essa

#### **Reference Textbooks**

3. Clinical Chemistry Fundamentals and Laboratory Techniques, Donna Larson EdD MT(ASCP)DLM
4. Tietz Fundamentals of Clinical Chemistry, 5th Edition, Carl A. Burtis Ph.D., Edward R. Ashwood MD

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**SYLLABUS**

**Subject: Biochemistry**

**Semester: V/VI**

**Course Title: Diagnostic Biochemistry -Practical**

**Course Code: 20BCP631DB2**

**No. of Hours: 45**

**LTP: 003**

**Credits: 2**

**Objectives**

- To impart skills in instrument handling.
- To highlight the importance of sample handling.

**Course Outcomes**

**CO1:** Understand various tests involved in sample analysis.

**CO2:** Analysis of Blood parameters.

**CO3:** Interpret the results based on the test.

**List of Practical**

**(30 Hrs.)**

1. Sampling and Handling of Biological samples.
2. Serum Lipid Profile Tests.
3. Haematological Analysis- ESR, Clotting time, and HbA1C.
4. Insulin Resistance Test.
5. Immunoglobulin testing

**Skill/Hands-on: Field Work/Mini Project**

**(15 Hrs.)**

1. Training students by industrial/technical experts.
2. Identification of different analysis instruments, their handling, and operational techniques with safety and security.
3. Visit nearby Diagnostic Labs.

**Prescribed Textbooks**

1. A Manual of Lab & Diagnostic Tests, Eighth Edition, CH, a Wolters Kluwer Business.
2. Clinical Chemistry: Practical Laboratory Diagnosis of Disease by David N. Bailey.



**Unit IV Reproductive Hormones****(9 Hrs.)**

Hormonal Contraception and fertility control- current approaches Testicular Diseases in men, Sexual Dysfunction in Men and Women, Menstrual Disorders and Pelvic Pain, The Menopause Transition and Postmenopausal Hormone Therapy.

**Unit V Variation in Hormones in life span****(9 Hrs.)**

Endocrine changes in pregnancy, Endocrinology of fetal development, Normal and aberrant growth, Hormonal changes in Puberty. Hormonal Imbalance and Hormone Level Testing.

**Co-Curricular Activities**

1. Assignments.
2. chart preparations.
3. Group discussions on case studies.
4. Student seminars.

**Prescribed Text Books**

1. Clinical Endocrinology - 2021 (The Clinical Medicine Series Book 25) by C. G. Weber M.D.
2. Endocrinology Thomas Fox, Antonia Brooke, Bijay Vaidya.

**Reference Text Books**

1. Endocrinology,3-Volume Set. Leslie Degroot, J. Larry Jameson.
2. Williams Textbook of Endocrinology, 12<sup>th</sup> Edition by Melmed.

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**SYLLABUS**

**Subject: Biochemistry**

**Semester: V/VI**

**Course Title: Clinical Endocrinology -  
Practical**

**Course Code: 20BCP732CE2**

**No. of Hours: 45**

**LTP: 003**

**Credits: 2**

**Objectives**

- To make students aware of the different hormone assays.
- To impart knowledge about hormone-specific assays.

**Course Outcomes**

CO1: Acquire knowledge of performing different enzyme assay.

CO2: Understand the biochemical basis of hormone-specific assay.

**List of Practical**

**(30 Hrs.)**

1. Assay of thyroxine (T4), and triiodothyronine (T3). Thyroid Stimulating Hormone.
2. Assay of Human chorionic gonadotropin (hCG).
3. Assay of FSH.
4. Assay of Prolactin.
5. Assay of Estradiol and Testosterone.

**Skill/Hands-on: Field Work/Mini Project**

**(15 Hrs.)**

- Training students by technical experts.
- Identification of different analysis instruments, their handling, and operational techniques with safety and security.
- Visit a nearby Diagnostic Laboratory.

**Prescribed Textbooks**

1. Handbook of Diagnostic Endocrinology, 3<sup>rd</sup> Edition, 2020.
2. Endocrinology: Adult and Pediatric, 7<sup>th</sup> Edition Volume-2.