

DAVANGERE  UNIVERSITY

Shivagangothri, Davangere-577007.

**Scheme and Syllabus for  
B.Sc. Degree Biochemistry**

**SEP Syllabus**

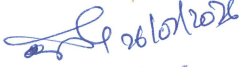
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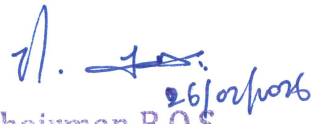
*for*

**Semester-V & VI  
(with effect from 2024-25)**

Department of Studies in Biochemistry  
Shivagangothri, Davangere-577007.

  
**Registrar**  
Davangere University  
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**DAVANGERE UNIVERSITY**  
**B.Sc. BIOCHEMISTRY**  
**(KSHEC-SEP Syllabus:2024-25)**  
**Semester V**

**24 SEPBC-VA: Bioenergetics and Metabolism**

**Total Hours -56**

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**Course Learning Objectives:**

- a) To understand the concepts of metabolism, characteristics of metabolic pathways.
- b) To gain a detailed knowledge of various catabolic and anabolic pathways.
- c) To acquire knowledge of high energy compounds and ATP.
- d) To understand the role of ETC and inhibitors, uncouplers.
- e) To systematically learn the breakdown/oxidation and biosynthesis of carbohydrates, amino acids, lipids & nucleic acids.

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**Course Outcome:**

On successful completion of the course, the student will able to:

- a) Understand the concepts of metabolism and gain a detailed knowledge of metabolic pathways.
  - b) Understand ATP generation through oxidative phosphorylation and electron transport chain.
  - c) Explain importance of enzymes, coenzymes, cofactors and inhibitors in metabolic reactions.
  - d) Learn the importance of metabolism to maintain homeostasis.
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**UNIT I :**

**14 Hr**

**Chapter 5.1.1**

**Bioenergetics:** Laws of thermodynamics, free energy change: exergonic and endergonic reactions, coupled reactions, meaning of  $\Delta G$ ,  $\Delta G^\circ$ ,  $\Delta G^{\circ\prime}$  equilibrium constant, ATP-ADP cycle, phosphorylation potential, and phosphoryl group transfers. High energy compounds. Chemical basis of high standard energy of ATP hydrolysis.

**Chapter 5.1.2**

**The electron transport chain** - Ultra structure of mitochondrion, electron transport chain. Electron transport complexes Complex I, II, III and IV. Uncouplers and inhibitors of respiration (ETC) (Rotenone, Actinomycin, Cyanide and 2,4 DNP).

**Chapter 5.1.3**

**Oxidative phosphorylation:** Oxidative phosphorylation, P/O ratio. Proton pumping, and proton gradient generation, redox loop, Q cycle, Peter Mitchell's Chemiosmotic hypothesis and Proton motive force. Fo-F1 ATP synthase, structure and mechanism of ATP synthesis.

**UNIT II:**

**14 Hr**

**Chapter 5.2.1**

**Metabolism:** Anabolism and catabolism, compartmentalization of metabolic pathways.

**Metabolism of Carbohydrates:** Reactions and energetics of glycolysis, entry of fructose, galactose, mannose and lactose into glycolytic pathway. Fates of pyruvate - conversion of pyruvate to lactate, alcohol and acetyl CoA. Cori's cycle. Glucose-Alanine cycle.

#### **Chapter 5.2.2**

Pyruvate dehydrogenase. Reactions and energetics of TCA cycle, amphibolic and integrating roles of TCA cycle. Anaplerotic reactions. Regulatory steps of glycolysis and TCA cycle.

#### **Chapter 5.2.3**

Gluconeogenesis and glycogenolysis. Pentose phosphate pathway and its significance.

### **UNIT III:**

**14 Hr**

#### **Chapter 5.3.1**

**Metabolism of Lipids:** Introduction, hydrolysis of triacylglycerols, transport of fatty acids into mitochondria,  $\beta$ - oxidation of saturated and unsaturated fatty acids, ATP yield from fatty acid oxidation.

#### **Chapter 5.3.2**

Biosynthesis of saturated and unsaturated fatty acids. Fatty Acid Synthase complex, Lipogenesis (*De novo* synthesis of Fatty acid), Elongation of Fatty acid (Mitochondrial elongation). Biosynthesis of TAG, Phospholipids (Lecithin and Cephalin). Cholesterol metabolism.

#### **Chapter 5.3.3**

**Nucleic acid metabolism:** Degradation of nucleic acids, action of nucleases-DNase I and II, RNase and phosphodiesterases. Catabolism of purines and pyrimidines. Salvage pathways. *De novo* biosynthetic pathways of purine and pyrimidine nucleotides. Conversion of ribonucleotides to deoxyribonucleotides.

### **UNIT IV:**

**14 Hr**

#### **Chapter 5.4.1**

**Metabolism of Amino acids:** General mechanism of amino acid metabolism: Deamination-oxidative and non – oxidative deamination, transamination, decarboxylation (biologically important amines) and desulphuration.

#### **Chapter 5.4.2**

Catabolism of carbon skeleton of amino acids, glycogenic and ketogenic amino acids.

#### **Chapter 5.4.3**

Urea cycle and its significance. Synthesis and catabolism of alanine, serine and cysteine.

### **SUGGESTED REFERENCES/TEXT BOOKS:**

1. Principles of Biochemistry, Donald Voet, Judith G Voet, Charlotte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
2. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012

3. Biochemistry- the chemical reactions of living cells, David E Metzler, 2nd Edition, Elsevier Academic Press,
4. Fundamentals of Biochemistry, Jain, J.L, S.Chand publication 6th Edition, 2005.
5. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Freeman and company, 7th Edition, 2010.
6. Harper's Illustrated Biochemistry, Victor W Rodwell, et.al,31st edition, McGraw Hill Education Lange ® 2018.
7. R.K.Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, HARPER'S BIOCHEMISTRY, 22nd edn. (1990), Prentice-Hall, International, USA.
8. P.K. Stumpf, OUTLINES OF BIOCHEMISTRY, 4th edn. (1994), Wiley Eastern, New Delhi, (Chapters 7 & 8).
9. Nelson and Cox, LEHNINGER's PRINCIPLES OF BIOCHEMISTRY, (2000), Kalyani Publishers, Ludhiana/Worth Publishers, Inc., New York.
10. L. Stryer BIOCHEMISTRY 4th Ed. (1995) W.H. Freeman Co., San Francisco, USA
11. G.L. Zubay BIOCHEMISTRY 4th Ed. (1998) W.C. Brown Publishers, USA.
12. Voet, D and Voet, J.G, (2009) Biochemistry, John Wiley and Sons, N.Y. USA.
13. Garret, R.H. and Grisham, C.M. (2005) Biochemistry, 3rd Edition. Thomson Learning INC.

**DAVANGERE UNIVERSITY**  
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**Semester V**

**24 SEPBC-VB : Clinical Biochemistry and Nutrition**

**Total Hours -56**

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**Course Learning Objectives:**

- a) To understand concepts and importance of clinical biochemistry and nutrition
  - b) To study disorders of biochemical transformations and basics of Nutrition.
  - c) To learn biological sampling, clinical laboratory tests.
  - d) To study diseases of digestion, disorders of liver, kidney, blood and blood cells, diagnostic enzymes.
  - e) To gain knowledge about energy requirements and the Recommended Dietary Allowances.
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**Course Outcome:**

On successful completion of the course, the student will able to:

- a) Understand the disorders of biochemical transformations and basics of Nutrition.
  - b) Learn biological sampling, clinical laboratory tests.
  - c) Understand diseases of digestion, disorders of liver, kidney, blood and blood cells, diagnostic enzymes.
  - d) Gain knowledge about energy requirements and the Recommended Dietary Allowances
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**Unit I: CLINICAL BIOCHEMISTRY**

**Chapter: 5 .1.1**

**14 Hr**

**Introduction:** Definition, scope of biochemistry in diagnosis, quality control external quality control, accuracy, precision, specificity. Collection and preservation of biological fluids - Blood and urine.

**Chapter: 5.1.2 Disorder of carbohydrate metabolism:** Blood sugar level and its clinical significance - hypoglycemia and hyperglycemia. Diabetes mellitus - definition, clinical features, biochemical and metabolic changes (in brief). Glucose tolerance test - definition, types (oral GTT to be discussed in brief). Cori diseases.

**Chapter: 5 .1.3Disorder of lipid and amino acid metabolism:** Ketosis and their clinical significance, blood cholesterol levels, Hypercholesterolemia, atherosclerosis. Disorder of amino acid metabolism - Alkaptonuria and phenylketonuria, hyperammonemia.

**Unit II**

**14 Hr**

**Chapter:5 .2.1**

**Organ function tests: Kidney:** Renal Function test- types (in brief).

**Clearance test:** Definition, urea clearance test (in brief).

**Chapter:5.2.2**

**Liver:** Disorders of Liver-Jaundice types and diagnosis by Van den Bergh reaction.

**Chapter: 5.2.3**

**Clinical Enzymology:** Definition of functional and nonfunctional plasma enzymes. Isoenzymes and diagnostic tests. Enzyme pattern in health and disease with special mention of plasma lipase, amylase, choline esterase, alkaline and acid phosphatase, SGOT, SGPT, LDH and CK.

**Unit III: NUTRITION****Chapter: 5.3.1****14 Hr**

**Nutrition:** Energy content of foods, Balanced diet Definition, characteristic feature of balanced diet, proximate analysis of foods for carbohydrate, proteins, fats, fiber material and water content. Bomb calorimeter diagram and description, Determination of calorific value of foods (Carbohydrate, fat and protein); respiratory quotient of food stuffs and significance of RQ.

**Chapter:5.3.2**

BMR determination by direct and indirect method; BOD; SDA definition; SDA for carbohydrate, fat and mixed diet and its significance.

**Chapter:5.3.3**

RDA for different physical activities: pregnant women, lactating woman, infants and children.

**Unit IV****14 Hr****Chapter:5 .4.1**

**Macronutrients:** Carbohydrate, proteins, lipid and fiber; Essential aminoacids, semi essential and non-essential aminoacids; complete and incomplete proteins, protein efficiency ratio; Nitrogen balance Positive and negative nitrogen balance. Fortification Definition and Biomedical importance.

**Protein Energy malnutrition:** Marasmus & Kwashiorkor causative factors, treatment and prevention.

**Chapter:5.4.2**

**Micronutrients:** Nutritional importance of vitamin, classification, source, daily requirements and functions; Deficiency symptoms.

**Chapter:5 .4.3**

Nutritional importance of Minerals Definition, classification, source, daily requirement and deficiency symptoms.

**SUGGESTED REFERENCES/TEXT BOOKS:**

1. Text Book of Biochemistry with Clinical Correlations – Thomas H. Devlin
2. Clinical Biochemistry –Controw & Trumper, , W.B. Saunders Pub (1986).
3. Harper's Review of Biochemistry with Clinical Correlations –D W Martin et al.
4. Principles of Biochemistry – A. White, P. Handler &E. Smith, McGraw – Hill.
5. Clinical Chemistry In: Diagnosis and Treatment – J. Zilva, P. Pannal.
6. Essentials of clinical pathology - Shirish M. Kawthalkar. JPB 1st edition (2010).
7. Clinical pathology, hematology and blood banking – Maheshwari Nanda, JPB.
8. Clinical pathology - James carton, Richard Dallyand P Ramani,OUP Oxford.

9. Advanced Textbook on Food & Nutrition-Dr. M. Swaminathan, Volumes 1 & 2, The Bangalore Press.
10. Advanced Nutrition and Human Metabolism - 7th Edn. Sareen S Gropper, Jack L Smith, & Timothy P Carr, Cenage Learning (2018).
11. Introduction to Human Nutrition - 2nd Edn. Michael J. Gibney, Susan A. Lanham-New, Aedin Cassidy, Hester H. Vorster, Wiley-Blackwell (2009).
12. Modern Nutrition in Health and Disease - 10 Ed. Shills et al., Lippincott Williams & Wilkins.
13. Nutrition: Everyday Choices - 1st Edition; Mary B. Grosvenor, Lori A. Smolin Wiley.
14. Bioactive Food as Dietary Interventions for Liver and Gastrointestinal Disease – R. Watson. V. Preedy, Elsevier (2012).
15. Nutrition and Metabolism - 2nd Edn., Lanham S, Mac Donald I and Roche H. The Nutrition Society, London, UK.
16. Introduction to Human Nutrition - 2nd Edn., Gibney M, Lanham S, Cassidy A and Vorster H. The Nutrition Society, London, UK.

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**SEP BSc-V Semester: Elementary Research Methodology**  
(for Biochemistry, Biotechnology, Botany, Chemistry, Electronics, Environmental Science, Food Technology, Microbiology, Zoology)

|                      |  |             |    |
|----------------------|--|-------------|----|
| Subject              | <b>Elementary Research Methodology</b> | Semester    | V  |
| Number hr/week       | 2 hours                                | Total hours | 32 |
| Duration of the exam | 2 hours                                | Credits     | 2  |

**Learning Outcomes:**

After the completion of this course the learner will be able to:

- Describe the basic concepts of research and its methodologies.
- Identify the appropriate research topics and set up hypothesis.
- Perform literature survey using library (print) and internet (online) sources.
- Design experiments/surveys, collect data and represent data in table and figure forms.
- Analyze data with appropriate software tools, internet results and draw conclusions.
- Write scientific report/ review and prepare seminar/ conference presentations oral or poster.
- Understand the methods of citations and referencing styles, check plagiarism.
- Identification of lacuna (finding gap-areas), hypothesis formulation, framing objectives, and preparation of questionnaire.

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| Unit-1 | <p><b>Scientific Methods and Research:</b> Concept, Definitions of research; Purpose, importance, steps levels and rigor of research; different paradigms of research.</p> <p><b>Types of Research:</b> Fundamental/Applied research, Descriptive/Analytical research, Quantitative /Qualitative research, Conceptual/Empirical research, Diagnostic/Hypothesis testing research, Conclusion oriented/Decision oriented research, Theoretical / Action research, Longitudinal /Cross sectional research</p> <p><b>Research Question:</b> Introduction, types and identification; <b>Research Problem:</b> Definition, identification of problem, ways of understanding problem, criteria of a good problem, guidelines for selecting meaningful problem; <b>Research Objective:</b> Definition, broad and specific objectives, goals;</p> <p><b>Research Hypothesis:</b> Meaning of research hypothesis, sources of hypothesis, qualities of workable hypothesis, utilities of hypothesis;</p> | 8 h |
| Unit-2 | <p><b>Introduction and review of sampling:</b> Definition, needs, steps; Definitions of population, sample, sampling unit, sampling frame, sampling error and non sampling error; Steps in sampling; Fundamentals, characteristics, advantages and disadvantages of sampling.</p> <p><b>Types of sampling:</b> Probability (simple, stratified, systematic, cluster and multistage –in brief), Process of selecting random sample; non probability sampling (convenience, purposive, quota, snowball, self selecting); Advantages and disadvantages (brief discuss only)</p> <p><b>Size of sample:</b> Factor affecting size of sample, Testing the reliability of sample, Methods of estimating sample size, Process of selecting random sample</p>   | 8 h |

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| Unit-3 | <p><b>Designing of research work:</b> Introduction, Purposes, Characteristics of a research design, Principles of designing a research, conceptual framework and its operationalization, Sectors of research design, Research methods as research designing, similarities and differences between Research design and research method. <b>Conventional research method:</b> Principle and Importance conventional methods, Scientific methods as conventional methods, Characteristic of a scientific method; Aspects of scientific Method, Evolution of scientific Studies Steps in scientific methods,</p>   | 8 h |
| Unit-4 | <p><b>Historical Research Method:</b> Nature and Steps in Historical method, Importance and fundamentals of Historical method, Sources of Historical data, Limitations.</p> <p><b>Experimental Research Method:</b> Introduction, Types of experiments, steps in experimental research, Problems in experimentation; Ex-post facto research: definition and technique.</p> <p><b>Survey Research Method:</b> Introduction, and Importance of survey method, Comparison of survey method with other methods; Objectives of social and survey and technical survey, types of social and technical survey, Steps in social and technical surveys, Pilot survey</p> <p><b>Case study:</b> Introduction, Types of case studies: Exploratory and Hypothesis testing; Steps in case studies, Sources of case data, limitations.</p> <p><b>Analysis of data-</b> introduction, data analysis tools.</p> <p>Project time line, literature review and references, research report structure, plagiarism.</p> | 8 h |

  
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 Dean-Science & Technology  
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**Registrar**  
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**Semester-VIA**

**24 SEPBC-VIA: MOLECULAR BIOLOGY AND GENETIC ENGINEERING**

**Total Hours -56**

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**Course Learning Objectives:**

- a) To understand the central dogma of molecular biology: replication, transcription, translation.
- b) To understand the role of different types of RNA in gene expression.
- c) To acquire knowledge DNA repair and gene regulation.
- d) To understand the tools in genetic engineering.
- e) To understand the importance of genetic engineering in different fields.

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**Course Outcome:**

**On successful completion of the course, the student will able to:**

- a) Understand the DNA as the genetic material.
- b) Learn the concept of DNA replication, RNA and protein synthesis.
- c) Acquire knowledge of restriction enzymes, vectors, host in genetic engineering.
- d) Understands the scope and applications of genetic engineering.

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**Unit I MOLECULAR BIOLOGY**

**Chapter:6.1.1**

**(14 Hr)**

**Genetic material:** DNA as a genetic material - Griffith transformation experiment and Hershey-Chase experiment. Introduction to Molecular Biology: Chromosomal organization in prokaryotes and Eukaryotes; Gene and gene concept: cistron, muton, and recon. Central dogma of molecular biology and its modification.

**Chapter:6.1.2**

**DNA Replication:** Types of replication-conservative, semi conservative, dispersive. Experimental verification of semi conservative mode of replication. Enzymes involved in replication. Mechanism of DNA replication in prokaryotes - Initiation, Elongation and Termination. outline of DNA replication in eukaryotes.

**Chapter:6.1.3**

**DNA damage (Mutation) and Repair:** Concept of mutation, Mutagens – chemical and physical, Molecular basis of mutation: spontaneous and induced mutations, effect of HNO<sub>2</sub>, alkylating agents, intercalating agents and UV-radiation. Point mutations: Concept of missense, non-sense and frame shift mutations. Repair by direct reversal of damage, excision repair, SOS repair.

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**Unit II**

**(14 Hr)**

**Chapter:6.2.1**

**Transcription (RNA Biosynthesis):** Transcription in prokaryotes - Transcription factors and machinery, formation of initiation complex, activators and repressors, Role of RNA polymerase, elongation, termination and post-transcriptional modifications.

**Chapter:6.2.2**

**Genetic code:** Deciphering of the genetic code - Nirenberg and Khorana work, general features, coding properties of t-RNA, wobble hypothesis.

**Chapter:6.2.3 Translation (Protein biosynthesis):** A brief account of ribosomes (in prokaryotes), activation of amino acid, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination. Post-translational modification and inhibitors of protein synthesis.

**Gene expression regulation:** Regulation of gene expression in prokaryotes its types, Operon concept- Lac operon, Trp Operon; Inhibitors - Replication, Transcription and Translation as targets for Antibiotic action.

**Unit III GENETIC ENGINEERING****(14 Hr)****Chapter: 6.3.1**

**Introduction:** Brief history and principles of genetic engineering, molecular tools of genetic engineering. **Enzymes used in r-DNA technology** - Types, detail account of restriction endonuclease and ligase. **Vectors** (The cloning vehicles)-Salient features of vectors, plasmids (PBR 322, Ti plasmid), bacteriophage ( $\lambda$  phage), cosmid (Hybrid vector), artificial chromosomal vectors (BAC). Steps involved in gene cloning.

**Chapter: 6.3.2**

**Methods of gene transfer-** Transformation, Conjugation, Electroporation, Liposome mediated gene transfer and direct transfer of DNA.

**Chapter: 6.3.3**

**Gene cloning strategies:** Cloning from genomic DNA or mRNA- Construction of chimeric DNA. Introduction of chimeric vectors to the host cell. Selection of transformed cell. Genomic library and its construction, c-DNA synthesis.

**Unit IV****14 Hr****Chapter: 6.4.1**

**Basic techniques in genetic engineering-** Isolation and purification of nucleic acid, cellular DNA, m-RNA, blotting techniques - Types (Southern, Northern and Western) and application. DNA sequencing method-PCR: Principle, methodology and applications. Site directed mutagenesis and protein engineering.

**Chapter: 6.4.2**

**Applications of Genetic engineering:** In disease diagnosis and medical forensic: DNA chip - Microarray of gene probes. DNA in the diagnosis of infectious disease, Genetic disease. Construction of gene bank, DNA finger printing, DNA markers in diseases, RFLP, VNTR, and SNP's.

### **Chapter: 6.4.3**

**Applications of Genetic engineering-** Insulin for Diabeticss, Recombinant vaccines, DNA vaccines, transgenic animals and plants, transgenic clones, gene therapy. Benefits and adverse effects of r-DNA technology in society. Introduction to Human Genome Project.

#### **SUGGESTED REFERENCES/TEXT BOOKS:**

1. Molecular Biology; Current Innovations and Future Trends; Griffin and Griffin, (1995), Horizon Scientific Press.
2. Molecular Biology and Biotechnology; Walker J.M. and Gingold E.B. [Eds.] (1992) Royal Society of Chemistry, London.
3. Practical Biochemistry; Principles and Techniques; K. Wilson and J. Walker (1995), Cambridge University
4. Biochemistry; David Rawn, J. (1989) Neil Patterson Publishers.
5. Biochemistry; Voet, D. and Voet, J.G. [Eds.] (1999) 3 Ed. Jhon Wiley and sons.
6. Molecular Biology of the Cell, Alberts et al., (1989) 2nd Edn. Garland Publications
7. Molecular biology of the gene (7th ed.). Watson JD, Baker TA, Stephen PB, et al., , San Francisco: Pearson Education, 2017.
8. Gene Cloning and DNA Analysis. T.A. Brown. Wiley Blackwell publisher (Oxford, UK), ISBN: 978-1-4051-8173-0, 2010.
9. Principles of Biochemistry; Lehninger et al., [Eds.] (1997) 2nd Edn. Worth Publishers.
10. Principles of Biochemistry; Smith et al., [Ed.] (1986) McGraw Hill.
11. Text Book of Biochemistry with Clinical correlations; Thomas Devlin [Ed.] (1997), Wiley Liss.
12. Recombinant DNA Technology: James D Watson , Scientific American Books, 1992.
13. Principles of Gene Manipulation and Genomics, Primrose, S.B., and Twyman, R. M., Blackwell publisher (Oxford, UK) ISBN:13: 978-1- 4051-3544-3, 2006
14. Molecular Biotechnology: Principles and Applications of Recombinant DNA: Glick B.R., Pasternak, J.J. and Patten, C.L., ASM Press (Washington DC), ISBN: 978-1-55581-498-4 (HC), 2010

**DAVANGERE UNIVERSITY**  
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**Semester-VIB**

**24 SEPBC-VIB : Immunology and Basic Endocrinology**

**Total Hours -56**

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**Course Learning Objectives:**

- a) To understand the basic concepts of immunity, immune system, nature of antigens and antibodies, immunological techniques.
  - b) To understand the concepts of immunity, immune reaction, immunization, immune disorders.
  - c) Understand the fundamentals of endocrinology, including hormone definition, classification, secretion, and regulation.
  - d) To understand the mechanisms of hormone action and second messenger systems.
  - e) To acquire knowledge about different endocrine glands, their roles in maintaining homeostasis.
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**Course Outcome:**

**On successful completion of the course, the student will able to:**

- a) Understand the components involved in humoral and cell-mediated immunity
  - b) Learn the role of immune response, over-activation and underactivation of immune system.
  - c) Describe different endocrine glands, their functions and regulations.
  - d) Understand the physiological roles of major endocrine hormones and their disorders.
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**UNIT I : IMMUNOLOGY**

**14 Hr**

**Chapter: 6.1.1**

**Over view and Nature of Antigen and Antibody**

**Organs of the immune system:** Anatomy and functions of lymphoid tissues, Cellular components of the immune system - Hematopoiesis, stem cells, granulocytes- Neutrophil, eosinophil, basophil

and Mast cell. Agranulocytes: Mononuclear cells- Lymphocytes, Monocytes, Macrophages, NK cells and Dendritic cells.

**Chapter: 6.1.2**

**Antigen:** Concept of antigenic determinants and immunogens, factors that influence immunogenicity, Classes of antigen, Epitopes, Haptens.

**Chapter: 6.1.3**

**Antibody:** Molecular Structure - general features, light and heavy chains, Hyper-variable and constant regions, Different isotypes and subtypes of immunoglobulins, Allotypes and idiotypes.

**UNIT II:**

**14 Hr**

**Chapter: 6.2.1**

**Innate immunity:** Anatomical and physiological barriers, Soluble factors, Inflammation-characteristics, initiation of the inflammatory response, Chemotaxis, Phagocytosis, Acute inflammatory response, Role of innate immunity. Cytokines, Complement system. Adaptive immunity.

**Chapter: 6.2.2**

**MHC molecules:** Genes, different classes, structure and function. Antigen processing and presentation: Endogenous and exogenous pathways.

**Chapter: 6.2.3**

**Humoral Immunity** – B cell receptors (BCR), B-Cell maturation, Activation, Differentiation, generation of plasma cells and memory B cells. Cell-mediated immunity: Structural organization of T cell-receptors, T-cell maturation, Activation, Differentiation, Proliferation, B cell – T cell interaction.

**Unit III: BASIC ENDOCRINOLOGY**

**14 Hr**

**Chapter: 6.3.1**

**Endocrine system:** Endocrine organs, hormones- classification.

**Chapter: 6.3.2**

Functions of the hormones of Hypothalamus, Pituitary, Adrenal, Thyroid, pancreas and Gonads.

**Chapter: 6.3.3**

**Concept of receptors-** Membrane and cytosolic. Mechanism of hormone action: Peptide hormones: General mechanisms of cell signaling by hydrophilic factors, transmembrane receptors, transmembrane receptors, G protein coupled receptors, receptor tyrosine kinase, eicosanoid receptors. Second messengers: IP<sub>3</sub>, DAG, cAMP, protein kinases.

**Unit: IV**

**14 Hr**

**Chapter: 6.4.1**

**Abnormalities:** Hypo and hyper production of hormones secreted by; pituitary, thyroid, pancreas, adrenals and gonads.. Regulation of hormone production and release: hypothalamus-pituitary-target organ axis and regulation by feedback mechanism.

### **Chapter:6.4.2**

**Mechanism of action of steroid hormones:** Conversion of cholesterol to steroid hormone. Steroid receptors, Pineal gland, melatonin and circadian rhythm.

Chemistry and action of prostaglandins, prostacyclins and thromoxanes.

### **Chapter:6.4.3**

**Insect hormones:** Structure and function of moulting hormone, ecdysone, juvenile hormones, Pheromones. Application of insect hormones.

### **SUGGESTED REFERENCES/TEXT BOOKS:**

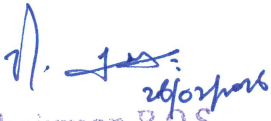
1. Introduction to Immunology – Nandini Shetty.
2. Punt J, Stranford S, Jones P and Owen J, Kuby immunology (8th ed.), New York: W.H. Freeman, 2018.
3. Murphy K, Mowat A, Weaver CT, Janeway's Immunobiology (8th ed), Garland Science, London & New York, 2012.
4. Delves PJ, Martin, SJ, Burton RD and Roitt IM, Roitt's essential immunology (13th ed.), London: Wiley-Blackwell, 2017.
5. Barrett KE, Barman SM, Brooks HL and Yuan JXJ, Ganong's review of medical physiology (26th ed.), New York: McGraw-Hill Education, 2019.
6. Rodwell VW, Bender DA, Botham KM, Kennelly PJ and Weil PA, Harper's illustrated biochemistry (31st ed.), Blacklick: McGraw-Hill Education, 2018.
7. Hall JE, Guyton and Hall textbook of medical physiology (13th ed.), Philadelphia: Saunders, 2016. Publ., Chennai, 2007
8. Principles of Biochemistry, Donald Voet, Judith G Voet, Charlotte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
9. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012
10. Biochemistry, Lubert Stryer , W.H Freeman and Company Limited

## 24 SEPBC-VI Practical: Molecular Biology and Immunology

1. Isolation of DNA from banana/endosperm of coconut/bacteria /any other source.
2. Isolation of RNA from Spinach leaves /any other source.
3. Isolation of plasmid from E coli.
4. Agarose gel electrophoresis [AGE] of DNA (Demo).
5. Estimation of DNA by Diphenylamine method.
6. Estimation of RNA by Orcinol method.
7. Western blotting
8. Identification of antigen by Radial Immunodiffusion technique.
9. Identification of antigen by Ouchterlony Immunodiffusion technique
10. Immunoelectrophoresis of serum or any biological sample.
11. Separation of serum and plasma from blood by centrifugation.
12. Blood grouping.
13. WIDAL test

### REFERENCES

1. Text book of Clinical Chemistry Teitz
2. Clinical chemistry in Diagnosis and Treatment by P.D Mayne/ Arnold. New Delhi
3. Medical Laboratory technology Kanai L. Mukherjee, Tata Mc Graw Hill Publication and Co. Ltd; Vol I, II, III
4. Practical Clinical Biochemistry Harold Varley CBS, New Delhi
5. Medical Laboratory Science, theory and practice. J. Ochei & A. Kolhakar, Tata Mc Graw Hill.
6. An Introduction to practical Biochemistry—Plummer D. T, Tata Mc Graw Hill
7. Lab manual of Biochemistry, Immunology and BioTechnology, Artinigam and Archana Ayyagiri Tata Mc Graw Hill.

  
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DAVANGERE UNIVERSITY  
B.Sc. BIOCHEMISTRY  
(KSHEC-SEP Syllabus: 2024-25)  
**Titles of the Theory papers/courses from  
Semester-III to Semester-VI**

**SEMESTER-III**

24SEPBC-III: BIOCHEMICAL TECHNIQUES AND ENZYMOLOGY  
TOTAL HOURS -56

24SEPBC-III Practical: BIOCHEMICAL TECHNIQUES

**Open Elective papers/courses**

24SEPBC-OE1(A): Basic Principles of Biochemistry  
TOTAL HOURS -32

24SEPBC-OE1(B): Clinical Biochemistry  
TOTAL HOURS -32

**SEMESTER-IV**

24SEPBC-IV: HUMAN PHYSIOLOGY  
TOTAL HOURS -56

24SEPBC-IV Practical: ENZYMOLOGY

**Open Elective papers/courses**

24SEPBC-OE2(A): Analytical Biochemistry  
TOTAL HOURS -32

24SEPBC-OE2(b): Nutritional in Health and Disease  
TOTAL HOURS -32

**SEMESTER-V**

24SEPBC-VA: BIOENERGETICS AND METABOLISM  
TOTAL HOURS -56

24SEPBC-VB: CLINICAL BIOCHEMISTRY AND NUTRITION  
TOTAL HOURS -56

24SEPBC-V Practical: CLINICAL BIOCHEMISTRY

**SEMESTER-VI**


24SEPBC-VIA: MOLECULAR BIOLOGY AND GENETIC ENGINEERING  
TOTAL HOURS -56

24SEPBC-VIB: IMMUNOLOGY AND BASIC ENDOCRINOLOGY  
TOTAL HOURS -56

24SEPBC-VI Practical: MOLECULAR BIOLOGY AND IMMUNOLOGY

  
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## 24 SEPBC-V Practical: Clinical Biochemistry

### Major Experiments

1. Verification of Beer-lamberts law for a given colored solution
2. Estimation of glucose colorimetrically by DNS method
3. Estimation of glucose colorimetrically by Folin-Wu method
4. Estimation of protein colorimetrically by Biuret method
5. Estimation of ferric ion using ammonium thiocyanate solution.
6. Estimation of Creatinine by Jaffe's method.
7. Estimation of Cholesterol by Zak's method.
8. Estimation of ascorbic acid in biological sample by indophenol method.
9. Estimation of inorganic phosphorous by Fiske-Subbarao method.
10. Estimation of amino acid (alanine/glycine) using ninhydrin by colorimetric method
11. Estimation of protein by FC method

### REFERENCES

1. Text book of Clinical Chemistry Teitz
2. Clinical chemistry in Diagnosis and Treatment by P.D Mayne/ Arnold. New Delhi
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B.Sc. BIOCHEMISTRY  
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Semester-III to Semester-VI**

**SEMESTER-III**

**24SEPBC-III: BIOCHEMICAL TECHNIQUES AND ENZYMOLOGY  
TOTAL HOURS -56**

**24SEPBC-III Practical: BIOCHEMICAL TECHNIQUES**

**Open Elective papers/courses**

**24SEPBC-OE1(A): Basic Principles of Biochemistry  
TOTAL HOURS -32**

**24SEPBC-OE1(B): Clinical Biochemistry  
TOTAL HOURS -32**

**SEMESTER-IV**

**24SEPBC-IV: HUMAN PHYSIOLOGY  
TOTAL HOURS -56**

**24SEPBC-IV Practical: ENZYMOLOGY**

**Open Elective papers/courses**

**24SEPBC-OE2(A): Analytical Biochemistry  
TOTAL HOURS -32**

**24SEPBC-OE2(b): Nutritional in Health and Disease  
TOTAL HOURS -32**

**SEMESTER-V**

**24SEPBC-VA: BIOENERGETICS AND METABOLISM  
TOTAL HOURS -56**

**24SEPBC-VB: CLINICAL BIOCHEMISTRY AND NUTRITION  
TOTAL HOURS -56**

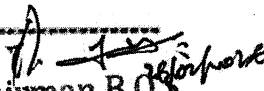
**24SEPBC-V Practical: CLINICAL BIOCHEMISTRY**

**SEMESTER-VI**

**24SEPBC-VIA: MOLECULAR BIOLOGY AND GENETIC ENGINEERING  
TOTAL HOURS -56**

**24SEPBC-VIB: IMMUNOLOGY AND BASIC ENDOCRINOLOGY  
TOTAL HOURS -56**

**24SEPBC-VI Practical: MOLECULAR BIOLOGY AND IMMUNOLOGY**

  
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## Practical proper Examination V & VI semesters

Duration: 3Hrs

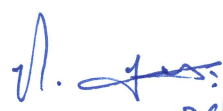
- Experimentation (Major & Minor/Spotters) - 30 Marks
  - Viva Voice - 10 Marks
- **Total 40 Marks**  
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## Internal Assessment for Practical Paper/Course V-VI semesters

- Attendance - 05 Marks
  - Record/Journal - 05 Marks
- **Total 10 Marks**  
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26/07/2016  
Department of Biochemistry  
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**Continuous Assessment Programme/Internal Assessment/Formative  
Assessment for Major Paper/Course/Subject: Biochemistry**

| Sl. No.            | Continuous Assessment Programme/Internal Assessment   | Maximum Marks |
|--------------------|---|---------------|
| (1)                | (2)   | (3)           |
| 01                 | Two Session Tests with proper record for assessment (5+5 = 10)  | 10            |
| 02                 | Assessment of Skill Development activities/Seminars/Group Discussion/ Assignment etc., with proper record | 05            |
| 03                 | • Attendance with proper record   | 05            |
| <b>TOTAL MARKS</b> |   | <b>20</b>     |

• **Attendance Marks-breakup**

|        |   |          |
|--------|---|----------|
| <75%   | - | 00 Marks |
| 75-80% | - | 01 Mark  |
| 80-85% | - | 02 Marks |
| 85-90% | - | 03 Marks |
| 90-95% | - | 04 Marks |
| >95%   | - | 05 Marks |

  
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**THEORY EXAMINATION QUESTION PAPER PATTERN FOR**  
**MAJOR PAPER/COURSE/SUBJECT: BIOCHEMISTRY**  
**(Semesters V & VI)**

**B.Sc. Semester-V/VI Degree Examination; 2026-27**  
**(Semester Scheme; New Syllabus: 2024-25)**

**SUBJECT: BIOCHEMISTRY**

Paper – \_\_\_\_\_ : \_\_\_\_\_  
Paper Code: \_\_\_\_\_

**Time: 3 Hours**

**Max. Marks: 80**

***Instructions to candidates:***

- 1) All sections are compulsory
- 2) Draw neat and labelled diagrams wherever necessary.

**SECTION-A**

1. Answer all the following questions:

**(2×10=20)**

- a)
- b)
- c)
- d)
- e)
- f)
- g)
- h)
- i)
- j)


**SECTION-B**

Answer any **SIX** of the following:

**(5×6=30)**

2. From Unit-I
3. From Unit-I
4. From Unit-II
5. From Unit-II
6. From Unit-III
7. From Unit-III
8. From Unit-IV
9. From Unit-IV

  
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**SECTION -C**

Answer **Any Three** of the following:

**(10×3=30)**

10. From Unit-I
  11. From Unit-II
  12. From Unit-III
  13. From Unit-IV
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