

SRI VENKATESWARA UNIVERSITY: TIRUPATI**B.Sc. Honours in BIOCHEMISTRY – MAJOR****w.e.f. 2024-25 onwards****COURSE STRUCTURE**

Year	Sem	Course	Title	No. Hrs./ Week	No. of Credits
I	I	1	Introduction to Classical Biology	5	4
		2	Introduction to Applied Biology	5	4
	II	3	Biomolecules - (T)	3	3
			Biomolecules - (P)	2	1
		4	Cell Biology - (T)	3	3
			Cell Biology- (P)	2	1
II	III	5	Analytical techniques- (T)	3	3
			Analytical techniques- (P)	2	1
		6	Basic Microbiology- (T)	3	3
			Basic Microbiology- (P)	2	1
		7	General Physiology- (T)	3	3
			General Physiology- (P)	2	1
		8	Genetics - (T)	3	3
			Genetics - (P)	2	1
	IV	9	Bioenergetics and Metabolism of Carbohydrates and Lipids-(T)	3	3
			Bioenergetics and Metabolism of Carbohydrates and Lipids- (P)	2	1
		10	Enzymology- (T)	3	3
			Enzymology- (P)	2	1
		11	Immunology - (T)	3	3
			Immunology - (P)	2	1

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IV -SEMESTER

Course No-9: BIOENERGETICS AND METABOLISM OF CARBOHYDRATES AND LIPIDS

COURSE OBJECTIVES

1. To acquire knowledge related to the intermediary metabolism and the role of TCA cycle in central carbon metabolism.
2. To learn basic concepts of Bioenergetics, the importance of high energy compounds, electron transport chain, synthesis of ATP, mechanisms of oxidative phosphorylation and photophosphorylation.
3. To understand the fundamentals of cellular metabolism of carbohydrates their association with various metabolic diseases.
4. To learn biosynthesis and degradation of Lipids, fatty acids and cholesterol, Metabolism of lipoproteins and Ketone bodies.

UNIT-I

Principles of thermodynamics, free energy, enthalpy and entropy, Free energy changes in biological transformations in living systems. Redox potential, phosphate group transfer potential and ATP, High-energy compounds, oxidation and reduction reactions.

UNIT-II

Oxidative phosphorylation, Mitochondria ultrastructure, Reducing equivalents, Electron transport and its carriers-Complex I, II, III, IV; Mitchell's Hypothesis, P: O ratio, ATP synthesis by F1-FO ATP synthase, Oxidation and reduction enzymes, utilization of oxygen by oxygenase's, superoxide dismutase and catalase. Respiratory control, Mechanism, and theories of oxidative phosphorylation. Respiratory chain inhibitors and uncouplers of oxidative phosphorylation.

UNIT-III

Approaches for studying intermediary metabolism. Glycolysis, and its regulation. TCA cycle – function and regulation, Glyoxylate cycle, Gluconeogenesis, and its regulation, HMP shunt and its significance, Uronic acid pathway, Glycogenesis & Glycogenolysis, Inborn errors of carbohydrate metabolism.

UNIT-IV

Lipid metabolism – Oxidation of fatty acids, Biosynthesis of fatty acids and regulation, Ketogenesis, Biosynthesis of triglycerides & degradation of triglycerides, lipoproteins.

UNIT-V

Metabolism of phospholipids, sphingolipids. Biosynthesis of cholesterol and its regulation, Role of liver and adipose tissue in lipid metabolism. Inborn errors of lipid metabolism.

Course Outcome:

1. Student can describe the principles of Thermodynamics
2. Student can explain electron transport mechanism.
3. Student acquire knowledge on Carbohydrate metabolism.
4. Student acquire knowledge on Lipid metabolism.
5. Student can explain synthesis of cholesterol and role of liver in lipid metabolism.

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IV -SEMESTER

Course No-9: BIOENERGETICS AND METABOLISM OF CARBOHYDRATES AND LIPIDS

PRACTICAL SYLLABUS

1. Isolation of casein from milk
2. Preparation of lactalbumin from milk
3. Estimation of reducing sugar by DNSA (dinitro salicylic acid) method
4. Titration of glucose by Benedict's method
5. Estimation of creatinine in serum
6. Estimation of cholesterol by ZAK's method

COURSE OUTCOMES

After the completion of this course, the student will be able to

1. Can isolate casein from milk and prepare lactalbumin from milk.
2. Can estimate creatinine serum.
3. Can estimate cholesterol and estimation of Glucose by Benedicts method.

RECOMMENDED BOOKS

1. Principles of Biochemistry, White. A, Handler, P and Smith.
2. Biochemistry, Lehninger A.L.
3. Biochemistry, David E. Metzler.
4. Biochemistry, Lubert Stryer.
5. Text Book of Biochemistry, West and Todd.

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IV -SEMESTER

Course No-10: ENZYMOLOGY

COURSE OBJECTIVES

1. To enlighten the students about enzyme kinetics.
2. To help the students to understand the mechanism of action of enzymes.
3. To help the students to learn the applications of enzymes.

UNIT-I

Introduction to enzymes: Holoenzyme, apoenzyme, prosthetic group. Interaction between enzyme and substrate- lock and key model, induced fit model, enzyme specificity and types. IUB system of classification and nomenclature of enzymes (Class and subclass with one example) Ribozymes, Abzymes.

UNIT-II

Enzyme kinetics: Importance, order of reaction, study of the factors affecting the velocity of enzyme catalyzed reaction- enzyme concentration, temperature, pH, substrate concentration, inhibitors and Derivation of Michaelis -Menten equation and K_m value determination and its significance. Definition of V_{max} value of enzyme and its significance. Lineweaver- Burk plot (Only for single substrate enzyme catalyzed reaction).

UNIT-III

Methods of measurements and expression of enzyme activity. Units of enzyme activity - definition and importance. Enzyme inhibition: Reversible and irreversible – examples. Reversible- competitive, noncompetitive and uncompetitive inhibition- explanation of double reciprocal plot with examples.

UNIT-IV

Enzyme regulation – covalently modulated enzymes with examples of adenylation and phosphorylation and allosteric regulation- example Aspartate trans-carbamylase. Isoenzymes- Lactate dehydrogenase and creatine phosphokinase. Zymogens.

UNIT-V

Immobilization of enzymes, methods of immobilization. Industrial uses of enzymes: Detergent enzymes, thermo stable alpha amylase, papain, and chymotrypsin.

Course Outcome:

1. Students can describe the classification of enzymes.
2. Student can explain enzyme kinetics.
3. Students acquire knowledge on units of enzyme activity and enzyme inhibition.
4. Student gain knowledge on enzyme regulation.
5. Student can explain about Immobilization of enzymes.

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Course No-10: ENZYMOLOGY

PRACTICAL SYLLABUS

- 01 Assay of α - amylase activity in saliva
- 02 Determination of optimum pH of a plant/animal or microbial enzyme.
- 03 Studying the effect of different temperatures during enzyme activity measurements.
- 04 Studying the effect of different pH during enzyme activity measurements.
- 05 Substrate saturation and determination of K_m value from Michaelis-Menten curve.

COURSE OUTCOMES

After completing this course, the student will:

- 1) Understand the effect of Temperature, pH during enzyme activity measurements
- 2) Study the enzyme activity of different enzymes

Recommended Books:

1. Enzymes: M. Dixon and E. C. Webb. Longman Publication
2. Enzymology: Nicholas and Price
3. Biochemistry: D.Voet and J. G. Voet, John Wiley C sons Inc. New York
4. Biochemistry: L. Stryer and Hall, J.E., Library of congress cataloguing-in publication Data, Bery, Jeremy mark ISBN -0-7167-4684-0.
5. Enzymes: Trevor Palmer Affiliated East- West Press Pvt. Ltd, New Delhi ISBN 81 7671-04

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IV -SEMESTER

Course No-11: IMMUNOLOGY

Course objectives

1. To have a key understanding of the components of immune system their functions and interactions
2. To understand the immune mechanisms involved in disease conditions.
3. To impart knowledge on the latest techniques in Immunology.

UNIT – I

Introduction to Overview of defense mechanisms in plants and animals.

Hematopoiesis, cells and organs of the immune system, primary and secondary lymphoid organs and tissues.

Unit – II

Innate immunity in plants and animals. Plants: Chemical and morphological defense in plants; elicitors receptors. Basal resistance and innate biochemical host defenses.

Animals: Anatomical barriers, cell types of innate immunity. Complement activation by classical path way. Biological consequences of complement activation. Connections between innate and adaptive immunity.

Unit- III

Adaptive immunity in plants and animals. Plants: Biotic interactions with symbionts, pathogens. Biochemical host defenses and basic compatibility. Interaction in host pathogen systems, receptor-elicitor model, plant gene-gene interaction. Cytological protection and induced resistance. Passive and active defenses. Animals: Antigens and Haptens, Factors that dictate immunogenicity, B and T cell epitopes.

Unit – IV

Structure and classes of Immunoglobulins (Ig), Ig effector functions of Antibody. Antigenic determinants on Ig and Ig super family. Antigen antibody interactions T and B - cell maturation, activation and effector response, positive and negative selection APC and Antigen presentation, Cytokines and Chemokines

Unit – V

Immune dysfunction and applications. Immunological tolerance; Immunological disorders – Hypersensitivity. Immuno-deficiencies

Course Outcome:

1. Student get an overview of the immune system and learn about the various cells, organs and tissues of the immune system.
2. Student learn the basic defense mechanisms of the human body, learn how our body differentiate self from non self and thus successfully eliminate any danger from outside.
3. Understand the cellular and molecular pathways of humoral and cell-mediated immune responses and appreciate the importance of immune system in health and disease.
4. Student learn about the structure and classes of various immunoglobulins, Antigen antibody interactions.
5. Learn how immunodeficiency makes us vulnerable and how vaccine is essential to protect us from infectious diseases.

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Course No-11: IMMUNOLOGY

Practical syllabus

1. Survey of structural plants defenses viz cuticle, wax, lignin, bark, thorns, prickles, trichomes.
2. Immunodiffusion – SRID
3. ABO and Rh blood grouping
4. Latex agglutination assay
5. Quantitative immune precipitation assay
6. Isolation of casein by isoelectric precipitation 1

COURSE OUTCOMES: After successfully completing this course, the students will be able to:

1. Acquire knowledge on structural plant defenses.
2. To get an overview of the SRID.
3. Acquire Knowledge on Agglutination Assay and Precipitation assay

RECOMMENDED BOOKS

- 1) Immunology, T .J. Kindt, R. A. Goldsby, and B.A. Osborne. (2007) W.H.Freeman and Co, New York.
- 2) Biochemistry, Voet, D. and Voet, J.G. (2004). 3rd Edition, John Wiley C Sons, Inc.USA.
- 3) Immunology - J. Kannan, MJP Publishers, Chennai.
- 4) Immunology - Roitt Ivan, Jonathan Brastoff, David Male, 1993.
- 5) Immunology - Janis Kuby, 4th edition, 2000.
- 6) Immunology - An introduction, Tizarrd, R. 1995.
- 7) Fundamentals of Immunology – Lippincot Praven publications, 4th edition
- 8) Essential and clinical Immunology - Halen chapel, Mansal Haney, Siraj Misbah and NialSnowdan.
- 9) Immunology - Geoffrey Zubay, W.M.C, Brown publishers, 4th edition 1992.