

SRI VENKATESWARA UNIVERSITY :: TIRUPATI
B.Sc. –Honours in BIOCHEMISTRY – MAJOR
w.e.f. 2025-26 AY onwards
COURSE STRUCTURE

Year	Semester	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
III	V	12	Nutritional Biochemistry - (T)	3	3
			Nutritional Biochemistry - (P)	2	1
		13	Clinical Biochemistry- (T)	3	3
			Clinical Biochemistry- (P)	2	1
		14	Molecular biology - (T)	3	3
			Molecular biology - (P)	2	1
		15	Metabolism of Nitrogen compounds - (T)	3	3
			Metabolism of Nitrogen compounds - (P)	2	1
	VI		Long term Internship/ Apprenticeship		

Marks allotment for each Theory and Practical paper

	SEE	IA	TOTAL
Theory	75	25	100
Practical	50	-	50

V- SEMESTER (2025-26)
Course No-12: NUTRITIONAL BIOCHEMISTRY

Course Objectives:

1. To compile various nutrition and balanced diets, various dietary requirements of nutrients.
2. To acquire knowledge about protein calorie malnutrition
3. To revise the facts about Fat- and Water-soluble vitamins and their importance.
4. To acquire the knowledge about food contaminants and antinutrients.
5. To extract facts about Obesity and various lifestyle associated diseases

UNIT- I

Animal and vegetative foods – chemical composition. Nutrients – Essential Nutrients and their classification. Digestibility, absorption and biochemical functions of macro nutrients, Carbohydrates – dietary requirements. Proteins – Nitrogen balance studies, Determination of Biological values of proteins, Specific Dynamic Action, Lipids – Dietary needs of lipids, essential fatty acids. Calorific values of foods, Basal metabolic rate and its determination, factors influencing BMR.

UNIT-II

Clinical nutrition – role of diet and nutrition in prevention of atherosclerosis and obesity, role of leptin in regulation of body mass. Starvation – Protein sparing treatment during fasting, Protein calorie malnutrition – Kwashiorkar and Marasmus, Nutritional requirements for pregnant and lactating women and aged people.

Unit-III

Biological effects of non-nutrients, dietary fibre, physiological actions. Antinutrients – Protease inhibitors, hemagglutinins, hepatotoxin, goitrogens, cyanogenic glucosides. Toxins from mushrooms. Biological effects of food contaminants – Hexachlorobenzene, arsenic, DDT, cadmium, mercury, lead, aflatoxins, food additives - saccharin and sodium nitrite. Animal foods and sea foods. Food allergy – role of allergens, diagnosis and management of food allergy.

UNIT-IV

Vitamins – Fat soluble vitamins (A, D, E, and K) and Water soluble vitamins (B complex and C) (Sources, biological functions and RDA), Disorders of vitamins A, D, E, K, Vitamin C and B-complex vitamins: Thiamin, Riboflavin, Niacin, Pantothenic acid, Lipoic acid, Pyridoxine, Biotin, folic acid and vitamin B12. Minerals- iron, calcium, iodine, selenium (Sources, biological functions and RDA). Deficiency disorders of minerals Nutritional requirements in infancy, childhood, pregnancy and lactation and old age.

UNIT- V

Obesity – Causes, Anthropometric measurements and Diet management. Dietary management in – Infection, Fever, Constipation, Diabetes mellitus, Peptic Ulcer, PCOS, Hypertension, Cardiovascular diseases, Pancreatitis, Cirrhosis and Cancer.

COURSE OUTCOME:

- 1) Students can analyse the role of various nutrients, their dietary allowances and relate in day-to-day life.
- 2) Student can revise the knowledge about the water- and fat-soluble vitamins and its significance and its functions
- 3) Student can outline the knowledge about Protein calorie malnutrition
- 4) Student can explain the biological effects of food contaminants
- 5) Student can outline the knowledge on Obesity and obtaining better results

Course No-12: NUTRITIONAL BIOCHEMISTRY

PRACTICAL SYLLABUS

- 1) Determination of total Ascorbic acid by DNPH method
- 2) Determination of calcium in the food
- 3) Isolation of casein from milk
- 4) Determination of cholesterol of edible oil
- 5) Determination of moisture content of foods/food grains/ powders
- 6) Determination of fructose from honey/fruit pulp
- 7) Determination of iodine value of edible oil by titrimetry
- 8) Determination of acid value by titrimetry

COURSE OUTCOME

1. Student can determine the calcium content in the food, cholesterol from edible oil.
2. Students can determine iodine value and acid value by titrimetric methods.

REFERENCE BOOKS:

- 1) Smith EL (1983) Principles of biochemistry: mammalian biochemistry: McGraw- Hill Companies.
- 2) Chatterjee CC (1951) Human physiology: Medical Allied Agency.
- 3) Murray R, Granner D, Mayes P, Rodwell V (2003)
- 4) Harper's illustrated biochemistry (LANGE basic science): McGraw-Hill Medical.
- 5) Guyton Aurcher C, Hall John E (2006) Text book of Medical Physiology. Elsevier India Pvt. Ltd. ND.
- 6) Dixon M, Webb E (1979) Enzyme inhibition and activation. Enzymes 3: 126-136.
- 7) Rao C (1973) University General Chemistry: An Introduction to Chemical Science: MacMillan.
- 8) Price NC, Frey PA (2001) Fundamentals of enzymology. Biochemistry and Molecular Biology Education.
- 9) Palmer T, Bonner PL (2007) Enzymes: biochemistry, biotechnology, clinical chemistry: Elsevier.

V - SEMESTER (2025-26)

Course No-13: CLINICAL BIOCHEMISTRY

COURSE OBJECTIVES

1. To understand the basic concepts of laboratory techniques.
2. To understand the basic concepts of organ functions.
3. To gain knowledge about various investigations and their interpretations.

UNIT-I

Clinical Biochemistry Laboratory and Investigation of Homeostasis. The use of biochemical tests- Specimen collection and types, Automation and Computerization Water and electrolyte homeostasis - renin angiotensin – aldosterone system Pathological variations of water and electrolytes- diagnosis and Interpretations

UNIT-II

Abnormal Hemoglobin and Inherited Disorders. Inborn errors of Metabolism: Patterns of inheritance - alkaptonuria, phenyl ketonuria, albinism, glycogen storage diseases and inherited disorders associated with urea cycle. Abnormal hemoglobin and hemoglobinopathies- Sickle cell anemia and thalassemias, porphyrias and porphyrinurias

UNIT-III

Investigation of Renal and Gastric Functions. Renal functions tests: Preliminary investigations, tests based on GFR, RPF and tubular function. Diseases related to kidney - nephritis, nephrosis, uremia, renal failure, renal calculi, renal tubular acidosis, diabetes insipidus.

Gastric function tests: Examination of resting content, Fractional gastric analysis, stimulation tests, Tubeless gastric analysis. Malabsorption syndrome, acidity, ulcers - gastric, pancreatitis, gastric and pancreatic function tests.

UNIT-IV

Liver Function Tests and Lipid Disorder. Liver function tests: Tests based on abnormalities of bile pigment metabolism, detoxification and excretory functions. Diagnosis of different types of jaundice. Pancreatic function tests. Diseases relating to liver - jaundice, cirrhosis, hepatitis,

Lipid: Lipoproteinemias and atherosclerosis coronary heart diseases and hypertension.

UNIT- V

Blood Glucose Regulation and Enzymes of Diagnostic Importance

Carbohydrates: Blood glucose level - regulation and its clinical significance, Diabetes mellitus, Glycosuria and GTT. Enzymes and Isoenzymes of clinical importance - general principles of assay - Clinical significance of enzymes and isoenzymes (LDH, CK, phosphatase, 5' nucleosidase, amylase, lipase, acetylcholinesterase, transaminase and gamma glutamyl transferase).

COURSE OUTCOMES

1. Student can obtain basic knowledge about specimen collections, pathological variations of water, electrolytes
2. Students can interpret the results to diagnose the abnormal functions of organs.
3. Correlate the tests used for renal and gastric functions and their interpretations
4. Impart the diagnostic tests for liver function and lipoprotein metabolic disorders
5. Evaluate the alterations in blood glucose regulation and enzymes of clinical importance

Course No-13: CLINICAL BIOCHEMISTRY

PRACTICAL SYLLABUS

1. Blood analysis: Iron and Hemoglobin, Glucose, GTT.
2. Serum and Urine analysis: Creatine, chloride, phosphorus, calcium.
3. Lipid profiles (Serum) – Total cholesterol, triglycerides, HDL, LDL
4. Liver function tests – Total Bilirubin, total protein, albumin, globulin, AST
5. Kidney function tests Urea, creatinine, uric acid.

COURSE OUTCOMES

After completing this course, the student will:

1. Analyze blood samples for Iron, Hemoglobin glucose and GTT.
2. Analyze serum for creatinine, lipid profile
3. Do liver function tests and kidney function tests

REFERENCE BOOKS

- 1) Gowenlock, A.H. and Donald, J (2002). Varley's practical clinical Biochemistry, sixth edition, CBS publications and Distributors, New Delhi.
- 2) Sembulingam, K and Sembulingam, P (2010). Essentials of Medical Physiology, fifth edition. Jaypae Brothers (p) ltd, New Delhi.
- 3) Burtis and Ashwood (2007) Tietz Fundamentals of Clinical chemistry, 6th edition, WB Saunders Company, Oxford Science Publications USA.
- 4) Chatterjee and Shindae (2012). Textbook of medical biochemistry, 8th edition.
- 5) Devlin, T.M (2010). TextBook of Biochemistry with clinical correlations, 7th edition.

V- SEMESTER (2025-26)

Course No-14: MOLECULAR BIOLOGY

COURSE OBJECTIVES

1. To introduce the type of DNA sequences and chromosome structure
2. To instill the knowledge of the molecular basis of DNA synthesis.
3. To understand the molecule basis of RNA synthesis and modified into different types of RNA
4. To discuss the genetic code, molecular basis of protein synthesis C modification.
5. To detail the mechanism of DNA mutation and Repair system.

UNIT- I

Gene Organization - Genes, DNA sequences – Unique and repetitive sequences, coding, non-coding DNA, Satellite DNAs, Cot Curves, Chromosomes – Types, properties, Gene organization in Prokaryotes and Eukaryotes **UNIT- II**

DNA Replication - Chemistry of DNA synthesis, Modes of DNA replication, Semiconservative Replication – Meselson and Stahl experiment, Enzymes of DNA replication – DNA polymerases, Helicases, Primase, Ligases, Topoisomerases, Prokaryotic replication. Brief outline of eukaryotic replication.

UNIT- III

Transcription - Chemistry of Transcription, RNA polymerases, Role of sigma factor, Closed and open promoter complexes, Prokaryotic Transcription, Post transcriptional modifications of mRNA – capping, tailing, splicing. **UNIT- IV**

Translation - Basic features and deciphering of the Genetic code, Genetic code dictionary, wobble hypothesis, Ribosomes, Protein synthesis in prokaryotes - Activation of amino acids, aminoacyl t-RNA synthetases, t-RNA as adaptor molecule, Prokaryotic translation, post translational modifications.

UNIT- V

Mutation and DNA Repair - Mutation – Types, Physical and chemical mutagens, DNA damages and mutations, DNA repair – Direct repair systems, Excision repair – Base and nucleotide excision repair, Mismatch repair.

COURSE OUTCOMES

On successful completion of the course, the student shall be able to:

- 1) Gain knowledge about the organization of genes and dynamics of DNA.
- 2) Gain knowledge about DNA Replication and its mechanism.
- 3) Gain knowledge about protein synthesis.
- 4) Understanding the mechanism of DNA repair and various mutations.

Course No-14: MOLECULAR BIOLOGY

PRACTICAL SYLLABUS

1. Study of semi-conservative replication of DNA through micrographs / schematic representation
2. Isolation of chromosomal DNA
3. Agarose gel electrophoresis and visualization
4. Study the effect of chemical (HNO₂) and physical (UV) mutagens on cells
5. Nucleic acid Leakage analysis

COURSE OUTCOME:

After the completion of the course

1. Student can explain semi conservative replication of DNA
2. Student can do agarose gel electrophoresis.

RECOMMENDED BOOKS:

1. Gene cloning C DNA analysis: Brown T. A., Blackwell publishing, Oxford, U.K., 6th Ed. 2010.
2. Biotechnology: applying the genetic revolution: Clark D. P. CPazdernik N. J., Elsevier academic. 2009.
3. Principles of gene manipulation and genomics: Primrose S. B. C Twyman. R.M., Blackwell Publishing, Oxford, U.K., 7th Ed. 2006.
4. Molecular cloning-a laboratory manual: Sambrook J. C Russell D., Cold Spring Harbor Lab Press, 3rd Ed. 2001.
5. Prescott, Harley C Klein's Microbiology: Wiley J. M., Sherwood L. M. C Woolverton C. J. Mcgraw Hill Higher Education. 7th Ed. 2008. Genomes-3: Brown T. A., Garland SC
6. Biochemistry - Voet Donald and Voet Judith: 2004. Wiley Int. Edition, 3rd Edition: John Wiley C Sons.
7. Lehninger Principles of Biochemistry – Nelson David and Cox Michael: 2004. W.H.Freeman Co: NY
8. Molecular cell biology – Lodish, Harvey, Berk, Arnold, Zipursky, Lawrence, Matsudaira, Paul, Baltimore: 2006, 4th Edition, W.H Freeman Co.
9. Lewin's Genes X– Krebs Jocelyn, Lewis Benjamin, Goldstein, Eliottt, Kilpatrick, Stephen: 2009.
10. The world of cells – Becker, Wayne, Kleinsmith, Lewis, Hardin, Jeff, Bertoni Gregory Paul: 2009, 7th Edition.
11. The Cell – molecular approach, Geoffrey M. Cooper C Robert E. Hausman, 3rd Edition.

V- SEMESTER (2025-26)

Course No-15: METABOLISM OF NITROGEN COMPOUNDS

COURSE OBJECTIVES

1. To help the students to understand the basic metabolic pathways
2. To help the students to understand the inter relationship between major foodstuffs

UNIT-I

General reactions- transamination- definition, reactions catalysed by SGOT and SGPT, Importance of transamination; Deamination - definition, oxidative and non- oxidative, examples for oxidative deamination- L- glutamate and non-oxidative glutamine.

UNIT-II

Decarboxylation - definition, decarboxylation of glutamic acid, Histidine. Urea cycle- individual reactions, importance of urea cycle, hyperammonemia, regulation of urea cycle. Interrelationship between urea cycle and TCA cycle.

Biosynthesis of glycine from serine and choline. Biosynthesis of alanine from transamination reaction. Biosynthesis of cysteine from L- serine. Epinephrine and Nor-epinephrine- importance and biosynthesis from tyrosine.

UNIT-III

Biosynthesis of purine and pyrimidine nucleotides- sources of nitrogen and carbon atoms of purine and pyrimidine rings. Precursors of purine and pyrimidine biosynthesis. Reactions involved in the biosynthesis. Conversion of nucleotides to deoxynucleotides. Orotic aciduria- general features. Gout; general features.

UNIT-IV

Factors regulate metabolic homeostasis; Importance of different organs and tissues in metabolism- With special emphasis on liver, skeletal muscle, brain, heart; brown and white adipocytes etc.; Importance of endocrine organs and hormones in metabolic regulations. Interconnections between carbohydrate, protein and lipid metabolism.

UNIT-V

Redox metabolism. Glutathione S-transferases in Redox Regulation and Glutathione Dependent Catalysis; Glutaredoxin and Thioredoxin Systems; Structural Basis of Redox Active Enzymes; Redox Activities of Antioxidants in a Cellular Context; Reactive Oxygen Species

COURSE OUTCOMES

1. Recognise the metabolism of proteins and metabolic profile of various tissues.
2. Correlate the metabolism of amino acids and their specialized products
3. Integrate the biosynthesis and degradative pathways of nucleic acids and their disorders

V- SEMESTER (2025-26)

Course No-15: METABOLISM OF NITROGEN

COMPOUNDS PRACTICAL SYLLABUS

- 1) Assay of aminotransferases: (a) Aspartate (b) alanine aminotransferases.
- 2) Assay of phenylalanine ammonia lyase.
- 3) Assay of nitrate and nitrite reductase.
- 4) Assay of Glutamine synthase.
- 5) Estimation of Allantoin and allantoic acid.
- 6) Assay of
nitrogenase.

COURSE

OUTCOMES

After completing this course, the student will:

1. Student will do the assay of aminotransferases, Glutamine synthase, and nitrogenase.

REFERENCE BOOKS:

1. Menninger's Principles of Biochemistry, David L. Nelson, Michael M. Cox. Publisher: W.H. Freeman.
2. Biochemistry-Jeremy M Publisher: WH Freeman Berg, John L Tymoczko, and Lubert Stryer.
3. Biochemistry, 4th Edition-Donald Voet, Judith G. Voet.—Publisher John WileyC Sons.
4. Biochemistry; Voet, D. and Voet, J.G. [Eds.] (1999) 3 Ed. Jhon Wiley and sons.
5. Biochemistry; David Rawn, J. (1989) Neil Patterson Publishers.
6. Principles of Biochemistry; Smith et al., [Ed.] (1986) Mc Garw Hill.