

# SHRI GNANAMBICA DEGREE COLLEGE: MADANAPALLE



(AUTONOMOUS)  
BIOTECHNOLOGY  
COURSE-8: METABOLISM  
SEMESTER III  
(W.E.F. 2025-2026)



Program: B.Sc. Biotechnology Honors

Hours per week: 4

Credits: 3

## COURSE OUTCOMES (COS)

By the end of this course, students will be able to:

**CO1:** Understand and explain the major pathways of carbohydrate metabolism, their regulation, and associated disorders such as diabetes mellitus.

**CO2:** Describe the biosynthesis and degradation of lipids, including clinical conditions like NAFLD and disorders of lipid metabolism.

**CO3:** Explain the metabolic pathways of amino acids, including urea cycle and inborn errors like Maple Syrup Urine Disease.

**CO4:** Demonstrate knowledge of enzyme classification, structure, specificity, and mechanisms of enzyme-substrate interaction.

**CO5:** Apply enzyme kinetic principles including Michaelis-Menten equation and enzyme inhibition to analyze enzyme behavior and industrial applications.

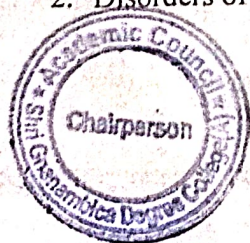
## SYLLABUS

### Unit I: Carbohydrate metabolism

1. Anabolism & catabolism, Photosynthesis – light and dark reactions. C3 cycle, C4 pathway,
2. Glycolysis – formation of lactate and pyruvate, TCA cycle and its regulation
3. Gluconeogenesis, HMP shunt pathway, Disorders of Carbohydrate metabolism-  
Diabetes mellitus
4. Role of Gut Microbiota in Carbohydrate Metabolism

### Unit II: Lipids metabolism

1. Denovo synthesis of Fatty Acids, Biosynthesis & degradation of TAG (Triacyl Glycerol),
2. Disorders of Lipid metabolism



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3. Biosynthesis of cholesterol, Ketogenesis
4. Non-Alcoholic Fatty Liver Disease (NAFLD)

### Unit III: Amino acid Metabolism

1. General reactions of amino acids, deamination, decarboxylation & transamination.
2. Urea cycle. Biosynthesis of creatine
3. Inborn errors of aromatic and branched-chain amino acid metabolism.

**Case Study: Maple Syrup Urine Disease (MSUD): Inborn error of branched-chain amino acid metabolism. Enzyme deficiency affecting oxidative decarboxylation. Clinical signs and dietary management strategies.**


### UNIT IV: Enzymes

1. Difference between chemical and biological catalyst, definitions of Holoenzyme apoenzyme coenzyme
2. Classification and nomenclature of enzymes.
3. Enzyme specificity, interaction between enzyme and substrate -lock and key and induced fit models.

### UNIT – V Enzyme kinetics

1. Michaelis-Menten equation, Factors affecting enzyme activity- substrate concentration, enzyme concentration, pH and temperature.
2. Enzyme inhibition kinetics -competitive, uncompetitive, and non-competitive
3. Immobilized enzymes and their applications



  
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## COURSE 8: METABOLISM - PRACTICALS

Practical

Credits: 1

2 hrs/week

1. Immobilization of enzymes / cells by entrapment in alginate gel 19. Effect of temperature / pH on enzyme activity
2. Assay of protease activity.
3. Assay of alkaline phosphatase
4. Preparation of starch from Potato and its hydrolysis by salivary amylase
5. Isolation of urease and demonstration of its activity
6. Estimation of amino acids by ninhydrin method
7. Estimation of protein by Biuret method
8. Estimation of glucose by DNS method
9. Estimation of glucose by Benedicts titrimetric method
10. Estimation of total carbohydrates by anthrone method

### REFERENCES


1. Understanding enzymes: Palmer T., Ellis Harwood Ltd., 2001.
2. Enzyme structure and mechanism. Alan Fersht, Freeman & Co. 1997
3. Principles of enzymology for food sciences: Whitaker Marc Dekker 1972.
4. Principles of Biochemistry, White. A, Handler, P and Smith.
5. Biochemistry, Lehninger A.L.
6. Biochemistry, Lubert Stryer.
7. Review of physiological chemistry, Harold A. Harper.
8. Text of Biochemistry, West and Todd.
9. Metabolic pathways – Greenberg.

### CO-CURRICULAR ACTIVITIES

#### Suggested Co-Curricular Activities

1. **Group Discussion: Topic:** *“Impact of diet and lifestyle on glucose metabolism”*
2. DIY Model Making
3. **Interactive Game / Quiz Bowl: Content:** Enzyme types, mechanisms, and models (lock & key, induced fit).
4. **Chart Making**



  
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COURSE-8: METABOLISM

SEMESTER III

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Program: B.Sc. Biotechnology Honors

Question Paper Blue Print

Time : 3 Hrs

Max Marks: 70

(Draw diagrams wherever necessary)

## I. Answer any Four Questions 4 X 5 =20

1. ....
2. ....
3. ....
4. ....
5. ....
6. ....
7. ....
8. ....

## II. Answer all the questions 5 X 10 = 50

1. (A).....

Or

(B).....

2. (A).....

Or

(B).....

3. (A).....

Or

(B).....

4. (A).....

Or

(B).....

5. (A).....

Or

(B).....



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Program: B.Sc. Biotechnology Honors  
Model Question Paper

Time : 3 Hrs

Max Marks: 70

(Draw diagrams wherever necessary)

## I. Answer any Four Questions 4 X 5 =20

1. Disorders of carbohydrate metabolism
2. Disorders of lipid metabolism
3. Inborn errors of aromatic amino acids
4. Holoenzyme and Apoenzyme
5. Factors affecting enzyme activity
6. Inhibition kinetics
7. C4 cycle
8. Cholesterol Biosynthesis

## II. Answer all the questions 5 X 10 = 50

1. (A) Glycolysis – formation of lactate and pyruvate  
Or  
(B) HMP stunt pathway
2. (A) Denovo synthesis of Fatty Acids  
Or  
(B) Ketogenesis
3. (A) Urea cycle  
Or  
(B) Deamination, Decarboxylation & Transamination
4. (A) Classification and nomenclature of enzymes  
Or  
(B) Interaction between enzyme and substrate
5. (A) Michaelis-Menten equation  
Or  
(B) Immobilized enzymes and their applications



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