JYOTI NIVAS COLLEGE AUTONOMOUS BANGALORE – 560 095
DEPARTMENT OF BIOCHEMISTRY
B.Sc. VI SEMESTER BIOCHEMISTRY PAPER VII SYLLABUS (2021 NEP BATCH)
ENZYMOLOGY AND CLINICAL BIOCHEMISTRY

COURSE TITLE	**ENZYMOLOGY AND CLINICAL BIOCHEMISTRY**
COURSE CODE	**21VIBC7(T)**
COURSE CREDITS	**04**
TOTAL CONTACT HOURS	**60 Hours**
DURATION OF ESE	**2 ½ Hours**
FORMATIVE ASSESSMENT MARKS	**40 Marks**
SUMMATIVE ASSESSMENT MARKS	**60 Marks**

Course Objectives: Through this course, the student is imparted with:

1. Enzymology: These topics will enable students to describe structure, functions, and the mechanism of action of enzymes. Learning kinetics of enzyme catalyzed reactions and enzyme inhibitions and regulatory process.
2. Clinical Biochemistry These topics will enable students to understand the fundamentals of clinical biochemistry to work in clinical laboratories.

Course Learning Outcomes: On completion of this course, the student should be able to:

1. Understand the properties and function of enzymes. different factors affecting enzyme activity
2. Explain the importance of enzyme specificity and understand the theories of enzyme kinetics and mechanism of enzyme catalysis
3. Explain the types of biological specimens that are commonly collected for testing
4. Interpret clinical function tests and laboratory procedures involved in assessment of various diseases
5. Understand the clinical importance of enzymes in the diagnosis and treatment of diseases.

CO NO.	Course outcomes statement	Knowledge level
1	Understand the properties and function of enzymes. different factors affecting enzyme activity	K1 & K2
2	Explain the importance of enzyme specificity and understand the theories of enzyme kinetics and mechanism of enzyme catalysis	K2 & K5
3	Explain the types of biological specimens that are commonly collected for testing	K1, K2, K4 & K5
4	Interpret clinical function tests and laboratory procedures involved in assessment of various diseases	K1, K2, K3 & K4
5	Understand the clinical importance of enzymes in the diagnosis and treatment of diseases.	K2, K3, K4, K5 & K6

K1 – Remember, K2 – Understand, K3 – Apply, K4 – Analyze, K5 – Evaluate, K6- Create

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	√	√					√			√
CO2	√	√		√			√		√	√
CO3	√	√	√				√		√	√
CO4	√	√	√			√	√		√	
CO5	√	√	√			√	√		√	√

Programme Objectives aligned with Graduate attributes

PO1- Knowledge

PO2- Scientific thinking

PO3- Entrepreneurial skills

PO4- Analytical skills

PO5- Communication skills

PO6- Social commitment

PO7- Research and Inquiry

PO8- Conservation of Environment

PO9- Employability

PO10- Academic orientation

UNIT-I – ENZYMOLOGY- I **15 hours**

Introduction to enzymes Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme, IUBMB classification of enzymes with examples. International Units of enzyme activity, specific activity. Monomeric and oligomeric enzymes- Monomeric enzymes, multifunctional enzymes, oligomeric enzymes and multi- enzyme complexes, isoenzymes- lactate dehydrogenase. Features of enzyme catalysis: Catalysis reaction rates and thermodynamics of reaction. Enzyme as catalyst. Activation energy and transition state theory, catalytic power, and specificity of enzymes (concept of active site), Theories of enzyme catalysis- Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.

UNIT- II - ENZYMOLOGY -II **15 hours**

Enzyme kinetics of single substrate reactions Review of Law of Mass Action. Equilibrium constant, mono substrate reactions, relationship between initial velocity and substrate concentration, derivation of Michaelis-Menten equation. Lineweaver- Burk plot. Determination of Vmax & Km and their significance, Kcat and turnover number. Factors affecting the rate of reaction- enzyme concentration, substrate concentration, pH, temperature, inhibitors and activators (including metal ions). Reversible inhibition- competitive, uncompetitive, non-competitive, mixed and substrate inhibition with graphical representations using L-B plots, Evaluation of Km and Vmax in presence of inhibitor. Irreversible inhibition- Suicide inhibition. Antibiotics as inhibitors- penicillin.

UNIT III CLINICAL BIOCHEMISTRY -I **15 hours**

Introduction to clinical biochemistry, Collection, transport, preservation and processing of biological specimens. - Blood, serum, plasma, urine, faeces, CSF, amniotic fluid. Anticoagulants used in hematology. Normal profile of cellular blood components: erythrocytes, leukocytes, and platelets. Hematological parameters - PCV, MCV, ESR, Hb, MCH, MCHC. Morphologic alterations of blood components in clinical conditions - Anaemia, polycythemia, leucopenia, leucocytosis, Thrombocytopenia. Haemophilia, Thalassemia, sickle cell Anaemia.

Liver function tests – Tests based on abnormalities of bile pigment metabolism, tests based on liver's part in carbohydrate metabolism – glucose, galactose and fructose tolerance tests, Tests based on changes in plasma proteins – total plasma proteins, amino acids in urine, flocculation tests. Tests based on abnormalities in lipids: serum cholesterol, faecal fats, Test based on excretion of injected substances by the liver – BSP retention test, I^{131} - Rose Bengal test. Formation of prothrombin by liver, Ammonia tolerance test. Activity of serum transaminases (sGOT and sGPT), ALP

UNIT IV CLINICAL BIOCHEMISTRY -II 15 hours

Gastric function tests - Examination of resting contents in gastric residuum, Fractional gastric analysis using a test meal, Examination of contents after stimulation: Alcohol stimulation, caffeine stimulation, histamine stimulation, insulin stimulation. Pentagastrin test. Serum amylase and lipase activity.

Renal function tests – Tests based on glomerular filtration: Urea clearance test creatinine clearance test, inulin clearance test. Tests to measure renal plasma flow: Para amino Hippurate test, filtration function test. tests based on tubular function: concentration and dilution tests, 15 -minute -PSP excretion test, tests to measure tubular secretory mass.

Other diagnostic enzymes: Myocardial infarction - Creatine phosphokinase (CPK), Lactate dehydrogenase (LDH), Gamma glutamyl trans peptidase (GGTP). Muscle – Aldolase

Detoxication tests: Introduction, Toxicants and their determination through function tests based on detoxication mechanisms: phase I and II.

Role of antioxidants: Definition, types of antioxidants: Enzymatic (SOD, CAT, GPx) and non-enzymatic antioxidants (Vitamin A, C and E, Glutathione). Functions of antioxidants.

REFERENCES:

- MN Chatterjea and Rana Shinde, Textbook of Medical Biochemistry, 8th Edition, Jaypee Brothers Medical Publishers, 2012.
- J L Jain, S. Jain and N. Jain,Fundamentals of Biochemistry, 7th Edition, S. Chand publication, 2016.
- Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 7th Edition, Macmillan Publications 2017.
- U. Sathyanrayana and U. Chakrapani. Biochemistry. 4th Edition, Elsevier Publication, 2013.
- D M Vasudevan, Sreekumari S, Kannan Vaidyanathan. Text book of Biochemistry for Medical Students. 9th Edition, Jaypee Brothers Medical Publishers, 2

BIOCHEMISTRY PRACTICAL PAPER 7

COURSE TITLE	**ENZYMOLOGY AND CLINICAL BIOCHEMISTRY**
COURSE CODE	**21VIBC7 (P)**
COURSE CREDITS	**02**
TOTAL CONTACT HOURS	**4 hours/week**
DURATION OF ESE	**03 hours**
CONTINUOUS INTERNAL ASSESSMENT (CIA)	**25**
END SEMESTER EXAMINATION (ESE)	**25**

Course outcome:

The practical course will enable the students to learn the assay of enzymes from different sources and they will able to study the kinetics of enzymes.

PRACTICALS

1. Salivary amylase/β- amylase
    a) Construction of Maltose/glucose calibration curve by DNS method and determination of activity of amylase
    b) Determination of specific activity of amylase
    c) Determination of pH optimum of amylase.
    d) Determination of Km and Vmax of amylase.
    e) Determination of optimum temperature of amylase.
    f) Effect of sodium chloride on amylase.
2. Determination of activity of yeast invertase.
3. Isolation of Urease and demonstration of its activity.
4. Isolation of Acid phosphatase and demonstration of its activity.
5. Isolation of Alkaline phosphatase and demonstration of its activity
6. Qualitative analysis of abnormal constituents in urine sample
7. Colorimetric estimation of any two abnormal constituents in urine sample (Glucose, Amino acid).
8. Estimation of bilirubin.
9. Estimation of protein by Lowry's method.
10. Estimation of a non-enzymatic oxidant (vitamin C).

REFERENCES:

1. An introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
2. Laboratory manual in biochemistry, Jayaraman J, New Age International publications, 2011
3. Practical Manual of Biochemistry, Sattanathan G., Swaminathan P. and Balasubramanian B. Sky fox press, 2020
4. Practical manual of Biochemistry, S.P Singh, 7th edition, CBS publications, 2013
Sawhney, S. K., and Randhir Singh. Introductory practical biochemistry. Alpha Science Int'l Ltd., 2000.