FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)
Department of Biochemistry
Course Curriculum

PART- A: Introduction				
Program: Bachelor in Science *(Diploma / Degree / Honors)*		**Semester - III**	Session: **2024-2025**	
1	**Course Code**	**BCSC- 03 T**		
2	**Course Title**	Enzymology		
3	**Course Type**	Discipline Specific Course (Theory)		
4	**Pre-requisite (if, any)**	As Per the Program		
5	**Course Learning. Outcomes (CLO)**	*On successful completion of the course, the student shall be able to:* ➢ Describe the enzyme catalysis and regulatory enzymes. ➢ Explain the mechanism of action of enzymes and role of vitamins as coenzyme precursors. ➢ Express the Michaelis-Menten equation, and double reciprocal plots, and graphical representation of various inhibitors. ➢ Describe the principles and methods of Diagnosis by enzymes.		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours - learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks: 40**	

PART -B: Content of the Course

Total No. of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics (Course contents)	No. of Period
I	**Introduction to enzymes:** Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes. Coenzymes. **Features of enzyme catalysis** Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis	09
II	**Enzyme kinetics:** Relationship between initial velocity and substrate concentration, steady state kinetics, equilibrium constant - Mono substrate reactions. Michaelis-Menten equation, Lineweaver-Burk plot, Km and Vmax, K_{cat} and turnover number. Effect of pH, temperature and metal ions on the activity of enzyme.	12
III	**Enzyme inhibition:** Reversible inhibition (competitive, uncompetitive, non-competitive, mixed and substrate). Mechanism based inhibitors. **Mechanism of action of enzymes** - General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme).	12
IV	**Regulation of enzyme activity:** Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbomoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage- zymogen. Multienzymecomplex as regulatory enzymes, pyruvate dehydrogenase. Isoenzymes - properties and physiological significance (lactate dehydrogenase). **Application of enzymes in diagnostics:** (SGPT, SGOT, creatine kinase, alkaline and acidphosphatases), Enzyme electrodes, biosensors.	12
Keywords	Coenzyme, Ribozyme, Cofactor, Apoenzyme, Michaelis-Menten equation.	

Name and Signature of Convener & Members of CBoS:

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H.Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
- Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt.Ltd. (New Jersey), ISBN:978-1180-25024.
- Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., OxfordUniversity Press Inc. (New York), ISBN:0 19 850229 X.

Online Resources–

e-Resources / e-books and e-learning portals

- https://www.jbc.org/Enzymology
- https://www.sciencedirect.com/topics/medicine-and-dentistry/enzymology
- https://www.biologyonline.com/dictionary/coenzyme
- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3770912/
- https://www.eposters.net/redirect/?ID=16026&UID=0&Type=poster
- https://link.springer.com/chapter/10.1007/978-0-387-35141-4_34

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks
Continuous Internal Assessment (CIA): 30 Marks
End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment / Seminar - **10** Total Marks - **30**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **30** Marks
End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20 Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit-**4x10=40 Marks**	

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PART- A: Introduction				
Program: Bachelor in Science *(Diploma / Degree/ Honors)*		**Semester -III**	Session: **2024-2025**	
1	**Course Code**	**BCSC- 03 P**		
2	**Course Title**	Enzymology		
3	**Course Type**	Discipline Specific Course (Practical)		
4	**Pre-requisite (if, any)**	As Per the Program		
5	**Course Learning. Outcomes (CLO)**	On successful completion of the course, the student shall be able to: ➢ Explain purification of proteins by various methods. ➢ Estimate enzyme activity by different methods. ➢ Explain progress curve of enzyme. ➢ Practice the effect of physical parameters on enzyme activity.		
6	**Credit Value**	**1 Credits**	***Credit =30 Hours Laboratory or Field learning/Training***	
7	**Total Marks**	**Max. Marks: 50**	**Min Passing Marks: 20**	

PART -B: Content of the Course

Total No. of learning-Training/performance Periods: 30 Periods (30 Hours)

Module	Topics (Course contents)	No. of Period
Lab./Field Training/ Experiment Contents of Course	➢ Partial purification of acid/ alkaline phosphatase. ➢ Assay of enzyme activity and specific activity, e.g. acid/ alkaline phosphatase. ➢ Effect of pH on enzyme activity and determination of optimum pH. ➢ Determination of Km and Vmax using Lineweaver-Burk graph. ➢ Isolation and purification of urease. ➢ Inhibition of alkaline/acid phosphatase activity by EDTA ➢ Effect of substrate concentration on alkaline phosphatase activityand determine of its Km value. ➢ Effect of temperature of enzyme activity and determination of activation energy. ➢ Effect of enzyme concentration on enzyme activity.	**30**
Keywords	Assay, Enzyme, Specific activity, Temperature,	

Name and Signature of Convener & Members of CBoS:

PART–C: Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

- Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292- 3414-8.
- Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.
- Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X.

Online Resources–

- **e-Resources / e-books and e-learning portals**
- https://en.wikibooks.org/wiki/Biochemistry
- https://www.pdfdrive.com/biomolecules-books.html
- https://ncert.nic.in/textbook.php

PART -D: Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks: **50 Marks**

Continuous Internal Assessment (CIA): **15 Marks**

End Semester Exam (ESE): **35 Marks**

Continuous Internal Assessment (CIA): **(By Course Teacher)**	Internal Test / Quiz-(2): **10 & 10** Assignment/Seminar +Attendance - **05** Total Marks - **15**	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **A. Performed the Task based on lab. work - 20 Marks** **B. Spotting based on tools & technology (written) – 10 Marks** **C. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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