TEACHING PLAN: Biochemistry and Plant Biotechnology (Dr. Santosh Joshi)

<table>
<tr><td colspan="3">SCHOOL: (SOBAS)
SCHOOL OF BASIC & APPLIED SCIENCES</td><td colspan="2">ACADEMIC SESSION: 2024</td><td>FOR STUDENTS' BATCH: B.Sc. Bio Semester VI</td></tr>
<tr><td>1</td><td>Course code</td><td colspan="4">BOT-302</td></tr>
<tr><td>2</td><td>Course Title</td><td colspan="4">Biochemistry and Plant Biotechnology</td></tr>
<tr><td>3</td><td>Credits</td><td colspan="4">3</td></tr>
<tr><td>4</td><td>Learning Hours</td><td></td><td>Contact Hours</td><td>38</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Practical Teaching</td><td>30</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Project, Tutorial and Assessment</td><td>22</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total hours</td><td>90</td><td></td></tr>
<tr><td>5</td><td>Course Objective</td><td colspan="4">1. This course primarily focuses to impart knowledge about the Biochemistry and Biotechnology.
2. To understand the structure and classification of enzymes and carbohydrates.
3. To study physical and chemical properties and biological functions of carbohydrates.
4. To understand the structure and classification of lipids.
5.To study physical and chemical properties and biological functions of lipids.
6. To understand basic concepts and terminology in plant biotechnology.</td></tr>
<tr><td>6</td><td>Course Outcomes</td><td colspan="4">After completing the course, the students will be able to:
. 1. Describe the mechanism of enzyme and their role in industries.
. 2. Explain the molecular structure and role of carbohydrates, proteins and lipids.
. 3. Explain the theory and practice of recombinant DNA technology.
. 4. Select and apply experimental procedures to the spectrum of fields making use of biotechnology.
. 5. Grow, maintain, and propagate different plant cell types in aseptic conditions.
. 6. Handle, store and analyse different culture and sub-cultures how these can be used for in vitro studies and secondary metabolite production.</td></tr>
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THEORY

Unit	Title & Contents	Number of Hours	Learning outcome	Course Outcome
Unit 1:	Basics of Enzymology: Discovery and nomenclature; characteristics of enzymes; concept of holoenzyme, apoenzyme, coenzyme and co-factors; regulation of enzyme activity; mechanism of action.	10	Know the activity of enzymes and their importance	CO1
Unit 2:	Carbohydrate: Introduction, importance, nomenclature, classification, molecular structure & function of mono, di, and poly sachrides, their properties, glycosidic linkages and glycoprotien. Protein: Amino acids-structure, electrochemical properties, peptide bonds, chemical bonds and nomenclature, structure and classification of proteins, physical and chemical properties.	10	Study the building blocks of living organisms and their importance	CO2
Unit 3:	Lipid metabolism: Structure and functions of lipids; fatty acid biosynthesis; β-oxidation; saturated and unsaturated fatty acids; storage and mobilization of fatty acids. Nitrogen metabolism: Biology of nitrogen fixation; importance of nitrate reductase and its regulation; ammonium assimilation.	10	Study the metabolism of macro molecules, modes of nitrogen fixation and its utility for plants and animals	CO2
Unit 4:	Genetic engineering and Biotechnology: Tools and techniques of recombinant DNA technology; cloning vectors; genomic and cDNA library; transposable elements; aspects of plant tissue culture; cellular totipotency, differentiation and morphogenesis; biology of Agrobacterium; vectors for gene delivery and marker genes.	10	Study the tools and techniques of DNA recombination and their implementation in improving breeds.	CO3, CO4, CO5 & CO6
	Augmentation done	NA		

Portions for Sessional examination

I - Sessional Exam	II- Sessional Exam	III- Sessional Exam	Re-Sessional Exam
Unit 1,2	NA	NA	Unit 1 2 3,4

Chapter No.	Title & Contents of the chapter	After completion of the chapter the student shall be able to	Skills and Competency Developed	Course Outcome
	Augmentation done	NA		

Portions for sessional examination

I- Sessional Exam	II- Sessional Exam	III- Sessional Exam	Re-Sessional Exam
Unit 1	NA	NA	Unit 1,2,3,4

Assessment of course outcomes:

Assessment method	Course outcomes in Percentage					
	CO1	CO2	CO3	CO4	CO5	CO6
Unit Test	√	√	√	√	√	
Sessional Examination						
Pre-final Exam			√	√	√	√
Assignment	√	√	√	√	√	√

Others Specify						

Course Outcomes-Program Outcomes mapping

COs	**Program Outcomes**										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**Total**
CO1	√	√			√			√	√		**5**
CO2	√	√			√			√	√		**5**
CO3	√		√		√	√		√	√		**6**
CO4	√		√		√	√		√	√		**6**
CO5	√	√	√		√	√		√	√		**7**
CO6		√	√								**2**
Total	**5**	**4**	**4**		**5**	**3**		**5**	**5**		

Modes of delivery of courses

Methodology	**Code**
Lecturing	**a**
Discussion	**b**
Group discussion	**c**
Demonstration	d
Power point presentation	e
Tutorial class	f
Assignment	**g**
Remedial class	i
Industrial visit	k
Quiz	m
Others specify	o

Assessment Method	**Code**
Viva	**A**
Continuous assessment	**C**
Unit test	**D**
Sessional exam	**E**
Assignments	**G**
Others specify	H

Teaching Aids used	Code
Marker & board	I
Power point	II
Videos	III
Posters	IV
Charts	V
Others specify	VIII

List of prescribed text books from University Syllabus

Sl No	Title of the book	Author/s	Edition, Year of Publication	Publisher	No. of copies available in the library
1	Plant Physiology and Biochemistry.	Srivastava H.S. & Shankar N.	2005	Rastogi Publications	
2	Plant Tissue Culture Applications and Limitations.	Bhojwani, S.S.	1990	Elsevier Science Publishers, New York, USA.	

List of text books for Augmented Syllabus

Sl No	Title of the book	Author/s	Edition, Year of Publication	Publisher	No. of copies available in the library
1					
2					

List of Reference text books from University Syllabus

Sl No	Title of the book	Author/s	Edition, Year of Publication	Publisher	No. of copies available in the library
1					
2					
3					

List of Journals / Articles / Dissertations

Sl No	Title of the book	Author/s	Edition, Year of Publication	Publisher	No. of copies available in the library
1					
2					
3					
4					

List of URLs / Blogs / Other e-Sources

Sl No	Title of the book	Author/s	Edition, Year of Publication	Publisher	Web-address
1	https://www.sciencedirect.com/science/article/pii/B9780128096338123829				
2	https://www.sciencedirect.com/science/article/pii/B9780444640468001415				
3	https://www.sciencedirect.com/science/article/pii/B9780128096338206614				
4	https://www.sciencedirect.com/science/article/pii/B978012819460700027X				
5	https://www.youtube.com/watch?v=TORRxwbz7aY				
6	https://www.youtube.com/watch?v=nfC689ElUVk				
7	https://www.youtube.com/watch?v=wuYNin4CjnY				
	https://www.youtube.com/watch?v=yesNHd9h8k0				

Questions

Unit-1

Sl No	Question	Max Marks	Related course outcome
1	Describe the mechanism of enzyme‘s reaction?	10	CO 1
2	Write a note on holoenzymes and give the table of cofactors of enzymes?		CO 1
3	Why enzymes are able to catalyse the reactions and justify your answer with diagrams?		CO 1
4	What do you understand by enzyme inhibitors and describe its type?		CO 1
5	Comments on the mode of action of enzymes with diagrams?		CO 1
7	Write shorts notes on enzymes?		CO 1
8	Comments on the major classes of the enzymes?		CO 1
9	Describe the properties of enzymes?		CO 1
10	Differentiate the ‘Lock & Key’ and ‘Induced Fit Model’?		CO 1
11	Write down the characteristics of the enzymes?		CO 1
12	What are enzymes? Classify enzymes according to the IUBMB system with suitable examples.		CO 1
13	Factors affecting enzymatic activity – enzyme concentration, pH, temperature and substrate concentration.		CO 1
14	Classify the following into one of the appropriate bonds – ester bond, peptide bond, glycosidic bond, hydrogen bond. a) Polysaccharide b) Protein c) Fat d) Water		CO 1

Unit 2

Sl No	Question	Max Marks	Related course outcome
1	What are carbohydrates?	10	CO 2
2	Describe the classification of carbohydrates?		CO 2
3	The molecular formula of galactose is C6H12O6.What is molecular formula of lactose?		CO 2
4	What are Monosaccharides, Oligosaccharides, and Polysaccharides?		CO 2
5	What are difference between Monosaccharides and Disaccharides explain with example?		CO 2
6	What is sterioisomers explain with example?		CO 2
7	What is difference between reducing disaccharides and non-reducing disaccharides?		CO 2

8	Write short note on biological function of carbohydrates?		CO 2
9	What is recemic mixture?		CO 2
10	Describe the structures and functions of any two homo and hetropolysaccharides?		CO 2
11	What are properties of amino acids?		CO 2
12	What are amino acids? Describe classification of amino acids?		CO 2
13	What are the secondary structures of protein?		CO 2
14	How can amine groups be classified?		CO 2
15	What is the importance of proteins for living organisms?		CO 2
16	What is the flat structural representation of an amino acid molecule?		CO 2
17	What is the difference between alpha-helix and beta-sheet protein conformations?		CO 2
18	What is the difference between essential and nonessential amino acids?		CO 2
19	What is the primary structure of a protein? What is the importance of the primary structure?		CO 2
30	Describe stability and bonds in proteins		CO 2

Unit 3

Sl No	Questions	Max Marks	Related course outcome
1	Write an account of nitrogen metabolism.	10	CO2
2	Write an account of nitrogen cycle and nitrogen fixation in plants.		CO2
3	Describe in brief about the reduction of nitrates in plant.		CO2
4.	Describe in brief about the nitrogen assimilation.		CO2
5.	Describe about the asymbiotic and symbiotic nitrogen fixation.		CO2
6.	Describe the biosynthesis of amino acids.		CO2
7.	What are the various forms of nitrogen available to plant? Describe in brief.		CO2
8.	Make a list of microbial involvement during biological nitrogen fixation.		CO2
9.	Describe in short, the role of blue green algae in nitrogen fixation.		CO2
10.	Write in brief about the role of leghaemoglobin.		CO2
11.	What is lipids?		CO2
12.	Describe the structure and classification of lipids?		CO2
13.	Write the biological significance of phospholipid?		CO2

14.	Difference between saturated and unsaturated fatty acid?		CO2
15.	Explain different type of fatty acid and their functions?		CO2
16.	Describe the structure of steroids with suitable example?		CO2
17.	Write the short note on essential fatty acid?		CO2
18.	Describe in brief the properties of fats and oils?		CO2
19.	Distinguish between fats and steroids?		CO2
20.	Write some difference between carbohydrates and lipids?		CO2

Unit 4

Sl No	Questions	Max Marks	Related course outcome
1.	How is the copy number of plasmid vector and yield of the recombinant protein related to each other?	10	CO3, CO4,CO 5 & CO6
2.	Can exonuclease be used while producing a recombinant DNA molecule?		CO3, CO4,CO 5 & CO6
3.	What are the features of a plasmid being used as a cloning vector?		CO3, CO4,CO 5 & CO6
4.	What are competent cells? What does the word “competent” refer to?		CO3, CO4,CO 5 & CO6
5.	What do “Eco”, “R” and “I” refer to in the enzyme EcoRI?		CO3, CO4,CO 5 & CO6
6.	Why are proteases added while isolating the DNA?		CO3, CO4,CO 5 & CO6
7.	If the “denaturation” step is missed during PCR, what would be its effect on the entire process?		CO3, CO4,CO 5 & CO6
8.	Name a recombinant vaccine.		CO3, CO4,CO 5 & CO6
9.	How is Ti plasmid of Agrobacterium tumefaciens modified to convert it into a cloning vector?		CO3, CO4,CO 5 & CO6
10.	Do biomolecules such as DNA, proteins exhibit biological activity in anhydrous conditions?		CO3, CO4,CO 5 & CO6
11.	What would happen if the restriction enzymes do not cut the DNA at specific recognition sequences?		CO3, CO4,CO 5 & CO6
12.	What is the role of *Agrobacterium tumefaciens* in plant transformation?		CO3, CO4,CO 5 & CO6

13.	Mention any three vector-less methods that are used to introduce recombinant DNA into a competent host cell.		CO3, CO4,CO 5 & CO6

Feedback on Curriculum

Formats have been developed for the following stakeholders

1. Present / Current students
2. Students just passing out (Exit Interview)
3. Alumni
4. Parents
5. Industry based supervisors
6. Placement (campus recruiters)
7. Departmental Advisory Board