BAGALKOT UNIVERSITY

Mudhol Road, Jamkhandi – 587301 Dist: Bagalkote

PROGRAM /COURSE STRUCTURE AND SYLLABUS
Of

MICROBIOLOGY

IV SEMESTER

BACHELOR OF SCIENCE
(MICROBIOLOGY)

As Per NEP – 2020 and Adapted from RCU Belagavi Applicable from the Academic

Year 2024-25

SEMESTER-IV											
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L7		Kannada	40	60	100	4	-	-	3	2
		Functional Kannada								
L8		English	40	60	100	4	-	-	3	2
		Hindi								
		Sanskrit								
		Arabic								
		Urdu								
DSC4	126BSC04MICDSC07T	Microbial Enzymology and Metabolism	40	60	100	4	-	-	4	2
	126BSC04MICDSC08L	Microbial enzymology & Metabolism lab	25	25	50	-	-	4	2	4
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
SEC	126COM03XXXSEC03T	Artificial Intelligence	20	30	50	1	-	2	2	2
VBC7	1126COM04XXXVBC08B	Yoga/ Sports	25	-	25	-	-	2	1	-
VBC8	126COM04XXXVBC09B	H&W, /NCC/NSS/R&R/CA	25	-	25	-	-	2	1	-
			Total Marks		**600**	**Semester Credits**			**22**	

Semester-4: BSc Microbiology (Basic/Hons)

Course code: 126BSC04MICDSC07T

Paper Title: Microbial Enzymology and Metabolism

Program Name	**BSc Microbiology**		Semester	**Fourth Sem**
Course Title	**Microbial Enzymology and Metabolism**			
Course No.	**MBL:104**	**DSC-4T**	No. of Theory Credits	**4**
Contact hours	**56 hrs**		Duration of ESA/Exam	**2 Hours**
Formative Assessment Marks	**40**		Summative Assessment Marks	**60**

Course Pre-requisite (s):.

Course Outcomes (COs): At the end of the course the student should be able to:

1. Differentiating concepts of chemoheterotrophic metabolim and chemolithotrophic metabolism.
2. Describing the enzyme kinetics, enzyme activity and regulation.
3. Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms

Content	**56 Hrs**
Unit–I	**14 Hrs**
Metabolism of Carbohydrates Chemo heterotrophic Metabolism- Anaerobic respiration and fermentation Concept of aerobic respiration, anaerobic respiration and fermentation. Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway, Phosphoketolase pathway. TCA cycle. Fermentation - Fermentation balance, concept of linear and branched fermentation pathways. Fermentation pathways: Alcohol fermentation and Pasteur effect; Butyric acid and Butanol-Acetone Fermentation, Mixed acid and 2,3-butanediol fermentation, Propionic acid Fermentation (Succinate pathway and Acrylate pathway), acetate Fermentation Chemolithotrophic Metabolism:Chemolithotrophy - Hydrogen oxidation, Sulphur oxidation, Iron oxidation, Nitrogen oxidation. Anaerobic respiration with special reference to disimilatory nitrate reduction and sulphate reduction.	

Unit -II	14 Hrs
. **Metabolism of amino acids, nucleotides and lipids** **1. Nitrogen Metabolism** Introduction to biological nitrogen fixation Ammonia assimilation. Assimilatory nitrate reduction, dissimilatory nitrate reduction, denitrification **2. Biosynthesis of ribonucleotides and deoxyribonucleotides** The de novo pathway. Regulation by feedback mechanisms. Recycling via the salvage pathway **3. Amino acid degradation and biosynthesis** **4. Lipid degradation and biosynthesis** **5. Metabolism of one carbon compounds:** Methylotrophs :i. Oxidation of methane, methanol, methylamines; ii. Carbon assimilation in methylotrophic bacteria and yeasts Methanogens: i. Methanogenesis from H_2, CO_2, CHOH, HCOOH, methylamines; ii. Energy coupling and biosynthesis in methanogenic bacteria Acetogens: Autotrophic pathway of acetate synthesis **6. Metabolism of two-carbon compounds:Acetate**: i. Glyoxylate cycle. **Acetic acid bacteria**: Ethanol oxidation, sugar alcohol oxidation. **Glyoxylate and glycolatemetabolism**:i. Dicarboxylic acid cycle, ii. Glycerate pathway iii. Beta hydroxyaspartate	
Unit -III	**14 Hrs**
Basics of Enzymes **Definitions of terms** – enzyme unit, specific activity and turnover number, exo/ endoenzymes, constitutive/ induced enzymes, isozymes. Monomeric, Oligomeric and Multimeric enzymes. Multienzyme complex: pyruvate dehydrogenase; isozyme: lactate dehydrogenase. Ribozymes, abzymes **Structure of enzyme**: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme, NAD, metal cofactors. Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis and Induced Fit hypothesis. Multisubstrate reactions -Ordered, Random, Ping-pong. **Enzyme catalysis:** Catalytic mechanisms with type examples, catalytic mechanisms and testing - Serine proteases and Lysozyme.	
Unit –IV	**14 Hrs**
Enzyme Kinetics and Regulation Enzyme Kinetics: Kinetics of one substrate reactions. i. Equilibrium assumptions ii. Steady state assumptions iii. Lineweaver-Burk, Hanes-Woolf, Eadie-Hofstee equations and plots. Kinetics of enzyme inhibition. Competitive, non-competitive and uncompetitive inhibition.Effect of changes in pH and temperature on enzyme catalysed reaction. Kinetics of two substrate reactions. Pre steady state kinetics. Kinetics of immobilized enzymes Enzyme regulation: Allosteric enzyme - general properties, Hill equation, KoshlandNemethy and Filmer model, Monod Wyman and Changeux model. Covalent modification by various mechanisms. Regulation by proteolytic cleavage - blood coagulation cascade. Regulation of multi- enzyme complex- Pyruvate dehydrogenase. Feedback inhibition. HIV enzyme inhibitors and drug design.	

Microbiology lab contents –Semester-4
Course code: 126BSC04MICDSC08L
Paper title: Microbial Enzymology and Metabolism

Course Title	**Microbial Enzymology and Metabolism Lab**		Practical Credits	**2**
Course No.	**MBL:104**	**DSC-4P**	Contact hours	56

Content

1. Handling of micropipettes and checking their accuracy
2. Isolation of cholesterol and lecithin from egg yolk
3. Identification of fatty acids and other lipids by TLC/GC
4. Determination of degree of unsaturation of fats and oils
5. Isolation of lactose from bovine milk
6. Estimation of total sugars by the phenol-sulphuric acid method
7. Estimation of DNA - DPA method & UV absorbance method
8. Estimation of RNA (Orcinol method)
9. Isolation of glutamic acid from gluten
10. Determination of molar absorption coefficient (ε) of l-tyrosine
11. Determination of the isoelectric point of the given protein
12. Estimation of polyphenols/ tannins by Folin- Denis method
13. Chemotaxis of *Pseudomonas*
14. Demonstration of alcoholic fermentation
15. Effect of variables on enzyme activity (amylase): a. Temperature b. pH c. substrate concentration d. Enzyme concentration e. Determination of Km of amylase (LineweaverBurke plot; Michaelis-Menton graph)

Practical assessment

Assessment			
Formative assessment		Summative Assessment	Total Marks
Assessment Occasion / type	Weightage in Marks	Practical Exam	
Record	5	25	50
Test	10		
Attendance	5		
Performance	5		
Total	25	25	