FYUGP-Scheme I-VIII Semester
Bachelor of Science (Honors/Research)
(Biotechnology - Major)
Four Year (Eight Semester Degree Course)
Teaching and Examination Scheme

B.Sc. Sem-I (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Introductory Microbial Biotechnology	BBT1T01	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Macromolecular Foundations of Biotechnology	BBT1T02	2	-	2	3	3	80	20	40	25	25	25
3	GE/OE	Refer GE/OE Basket	BGO1T01	2	-	-	2	3	80	20	40	-	-	-
4	GE/OE	Refer GE/OE Basket	BGO1T02	2	-	-	2	3	80	20	40	-	-	-
5	VSEC	Refer VSC Basket	BVS1P01	-	-	4	2	-	-	-	-	50	50	50
6	VSEC	Refer SEC Basket	BVS1P02	-	-	4	2	-	-	-	-	50	50	50
7	AEC	English Compulsory	BAE1T01	2	-	-	2	3	80	20	40	-	-	-
8	VEC	Environmental Sci.	BVE1T01	2	-	-	2	3	80	20	40	-	-	-
9	IKS	Indian Knowledge System	BIK1T01	2	-	-	2	3	80	20	40	-	-	-
10	CC	NSS/NCC/Yoga	BCC1P01	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**560**	**140**		**150**	**250**	

B.Sc. Sem-II (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Technical Foundations of Biotechnology	BBT2T03	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Enzyme Technology	BBT2T04	2	-	2	3	3	80	20	40	25	25	25
3	GE/OE	Refer GE/OE Basket	BGO2T03	2	-	-	2	3	80	20	40	-	-	-
4	GE/OE	Refer GE/OE Basket	BGO2T04	2	-	-	2	3	80	20	40	-	-	-
5	VSEC	Refer VSC Basket	BVS2P03	-	-	4	2	-	-	-	-	50	50	50
6	VSEC	Refer SEC Basket	BVS2P04	-	-	4	2	-	-	-	-	50	50	50
7	AEC	English Compulsory	BAE2T02	2	-	-	2	3	80	20	40	-	-	-
8	VEC	Constitution of India	BVE2T02	2	-	-	2	3	80	20	40	-	-	-
9	IKS	Indian Knowledge System	BIK2T02	2	-	-	2	3	80	20	40	-	-	-
10	CC	Health & Wellness	BCC2P02	-	-	4	2	-	-	-	-	-	100	50
Total				14	-	16	**22**		**560**	**140**		**150**	**250**	

B.Sc. Sem-III (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Biology –I	BBT3T05	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Molecular Biology -II	BBT3T06	2	-	2	3	3	80	20	40	25	25	25
3	Minor	Minor 1 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
4	Minor	Minor 2 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
5	GE/OE	Refer GE/OE Basket	BGO3T05	2	-	-	2	3	80	20	40	-	-	-
6	VSEC	Refer VSC Basket	BVS3P05	-	-	4	2	-	-	-	-	50	50	50
7	AEC	Second Language	BAE3T03	2	-	-	2	3	80	20	40	-	-	-
8	FP	Field Project	BFP3P01	-	-	4	2	-	-	-	-	50	50	50
9	CC	Sports/Cultural	BCC3P03	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**480**	**120**		**200**	**300**	

B.Sc. Sem-IV (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Fundamentals of Genetic Engineering	BBT4T07	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Microbial Genetics	BBT4T08	2	-	2	3	3	80	20	40	25	25	25
3	Minor	Minor 3 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
4	Minor	Minor 4 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
5	GE/OE	Refer GE/OE Basket	BGO4T06	2	-	-	2	3	80	20	40	-	-	-
6	VSEC	Refer SEC Basket	BVS4T06	-	-	4	2	-	-	-	-	50	50	50
7	AEC	Second Language	BAE4T03	2	-	-	2	3	80	20	40	-	-	-
8	CEP	Community Service	BCM4P01	-	-	4	2	-	-	-	-	50	50	50
9	CC	Applied/Visual/ Performing Art	BCC4P04	-	-	4	2	-	-	-	-	-	100	50
Total				12	-	20	**22**		**480**	**120**		**200**	**300**	

B.Sc. Sem-V (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Immunology	BBT5T09	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Medical Biotechnology	BBT5T10	2	-	2	3	3	80	20	40	25	25	25
3	DSC	Techniques for gene editing	BBT5T11	2	-	2	3	3	80	20	40	25	25	25
4	DSE	Elective 1	BBT5T12	3	-	2	4	3	120	30	60	25	25	25
5	Minor	Minor 5 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
6	Minor	Minor 6 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
7	VSCE	Refer VSC Basket	BVS5P07	-	-	4	2	-	-	-	-	50	50	50
8	CEP	Community Service	BCM5P02	-	-	2	1	-	-	-	-	25	25	25
Total				**13**	**-**	**18**	**22**	**-**	**520**	**130**	**–**	**225**	**225**	**-**

B.Sc. Sem-VI (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Industrial Biotechnology	BBT6T13	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Environmental Biotechnology	BBT6T14	2	-	2	3	3	80	20	40	25	25	25
3	DSC	Gene Transformation Techniques	BBT6T15	2	-	2	3	3	80	20	40	25	25	25
4	DSE	Elective 2	BBT6T16	3	-	2	4	3	120	30	60	25	25	25
5	Minor	Minor 7 (Refer Minor Basket)		2	-	2	3	3	80	20	40	25	25	25
6	VSCE	Refer VSC Basket	BVS6P08	-	-	4	2	-	-	-	-	50	50	50
7	OJT	Internship (Related to DSC)	BOJ6P01	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	22	**22**		**440**	**110**		**275**	**275**	

B.Sc. Sem-VII (Honors) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genomics	BBT7T17	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Proteomics	BBT7T18	2	-	2	3	3	80	20	40	25	25	25
3	DSC	Bioinformatics-I	BBT7T19	2	-	2	3	3	80	20	40	25	25	25
4	DSC	Bioinformatics-II	BBT7T20	2	-	2	3	3	80	20	40	25	25	25
5	DSE	Elective 3	BBT7T21	3	-	2	4	3	120	30	60	25	25	25
6	RM	Research Methodology	BBT7T22	2	-	4	4	3	80	20	40	50	50	50
Total				13	-	14	**20**		**520**	**130**		**175**	**175**	

B.Sc. Sem-VIII (Honors) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
								Theory				Practical		
				(Th)	TU	P		Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Molecular Diagnostics	BBT8T23	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Agricultural Biotechnology	BBT8T24	2	-	2	3	3	80	20	40	25	25	25
3	DSC	Systems Biology-I	BBT8T25	2	-	2	3	3	80	20	40	25	25	25
4	DSC	Systems Biology-II	BBT8T26	2	-	2	3	3	80	20	40	25	25	25
5	DSE	Elective 4	BBT8T27	3	-	2	4	3	120	30	60	25	25	25
6	OJT	Apprenticeship (Related to DSC)	BOJ8P02	-	-	8	4	-	-	-	-	100	100	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

B.Sc. Sem-VII (Research) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min.	SEE	CIE	Min.
1	DSC	Genomics	BBT7T17R	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Proteomics	BBT7T18R	2	-	2	3	3	80	20	40	25	25	25
3	DSC	Bioinformatics	BBT7T19R	2	-	2	3	3	80	20	40	25	25	25
3	DSE	Elective 3	BBT7T20R	3	-	2	4	3	120	30	60	25	25	25
5	RM	Research Methodology	BBT7T21R	2	-	4	4	3	80	20	40	50	50	50
6	RP	Research Project/ Dissertation (Core)	BRP7P01	-	-	6	3	-	-	-	-	75	75	100
Total				11	-	18	**20**		**440**	**110**		**225**	**225**	

'R' in the subject code indicates 'Research'.

B.Sc. Sem-VIII (Research) (Biotechnology- Major)

SN	Course Category	Name of Course	Course Code	Teaching Scheme (hrs.)			Total Credit	Examination Scheme						
				(Th)	TU	P		Theory				Practical		
								Exam Hrs.	SEE	CIE	Min	SEE	CIE	Min
1	DSC	Molecular Diagnostics	BBT8T22R	2	-	2	3	3	80	20	40	25	25	25
2	DSC	Agricultural Biotechnology	BBT8T23R	2	-	2	3	3	80	20	40	25	25	25
3	DSC	Systems Biology	BBT8T24R	2	-	2	3	3	80	20	40	25	25	25
4	DSE	Elective 4	BBT8T25R	3	-	2	4	3	120	30	60	25	25	25
5	RP	Research Project / Dissertation (Core)	BRP8P02	-	-	14	7 (4+2+1)	-	-	-	-	175	175	175
Total				09	-	22	**20**		**360**	**90**		**275**	**275**	

'R' in the subject code indicates 'Research'.

Total Credits:

1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations: Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

Basket for Minor Category Courses (Biotechnology)

Semester	Course Category	Name of Course	Course Code
IIII	Minor 1	Introductory Microbial Biotechnology	BBT1T01
	Minor 2	Cellular Macromolecules	BBT1T02
IV	Minor 3	Techniques in Biotechnology	BBT2T03
	Minor 4	Enzyme Technology	BBT2T04
V	Minor 5	Molecular Biology–I	BBT3T05
	Minor 6	Molecular Biology-II	BBT3T06
VI	Minor 7	Fundamentals of Genetic Engineering	BBT4T07

Basket for ELECTIVE (DSE) Category Courses (Biotechnology)

Semester	Course Category	Name of Course	Course Code
V	Elective 1	**A.** Vaccinology	BBT5T12
		B. Gene Therapy	
VI	Elective 2	**A.** Fermentation Technology	BBT6T16
		B. Food Biotechnology	
VII (Honors)	Elective 3	**A.** Drug Discovery and Development	BBT7T21
		B. Transcriptomics	
VIII (Honors)	Elective 4	**A.** Ethics in Biotechnology	BBT8T27
		B. Nanobiotechnology	
VII (Research)	Elective 3	**A.** Drug Discovery and Development	BBT7T20R
		B. Transcriptomics	
VIII (Research)	Elective 4	**A.** Ethics in Biotechnology	BBT7T25R
		B. Nanobiotechnology	

'R' in the subject code indicates 'Research'.

BSc Biotechnology (Hons./Res)

Semester 1

Course Pre-requisite(s): *Basic Training in Chemical and Biological Concepts at the level of Higher Secondary.*

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Describe at conceptual level the microbial cell suitability for execution of biotechnological principles.

2. Diagrammatically demonstrate structure of various categories of microorganisms routinely utilized for biotechnological purposes.

3. Conceptualize handling of microbes for biotechnology applications.

4. Establish correlation of macromolecular organization and function at cellular level.

5. Design basic strategy for associating changes in DNA with cellular functioning.

6. Establish enzymatic correlation for execution of DNA manipulations

7. Select technical methods for analysis of manipulated Biomolecules

BSc Biotechnology (Hons./Research)

Semester 1

Title of the Courses:

Course 1 BBT1T01: DSC-1 Introductory Microbial Biotechnology

Course 2 BBT1T02: DSC-2 Macromolecular Foundations of Biotechnology

Course 3 BBT1P01: DSC-1P Practical

Content of Course 1 (Course Code: BBT1T01)Theory DSC **Introductory Microbial Biotechnology**	**30 Hrs**
Unit – 1: Microorganisms: Concept and Importance	7 Hrs
Relevance of Microbiology in the field of Biotechnology; Landmark discoveries (Anton van Leuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Edward Jenner, Alexander Fleming); Distinguishing features of Prokaryotic and Eukaryotic microorganisms General Morphology of Bacteria: Size, Shapes and Arrangement; Bacterial Cell Structure: Slime layer and Capsule, Flagella and Fimbriae, Ribosomes, Endospore: Endospore structure & its formation, Basis of resistance; Cell inclusions (Gas vesicles, Carboxysomes, Magnetosomes, PHB granules, Glycogen bodies, Metachromatic granules)	
Unit -2: Bacterial Cultivation and Growth	7 hrs
Basic nutritional (Macro and micronutrients) and Environmental (temperature, oxygen and pH) requirements of Bacteria; Types of culture medium: Liquid, semi-solid and solid media; Selective media, Enrichment media, Enriched media, Differential media. Nutritional classification of bacteria (phototrophs, chemotrophs, autotrophs, heterotrophs, prototrophs, auxotrophs). Concept of Pure culture, Maintenance of pure cultures. Replica plating for isolation of mutants, screening of mutants/recombinants (Lederberg experiment) Details of growth curve & its various phases. Concept of culturable and non-culturable bacteria (VBNC).	
Unit – 3: Technical Foundations of Microbiology	8 hrs
Importance of Sterilization; Physical methods of control: Moist Heat (Boiling, Pasteurization, Fractional sterilization, Autoclave), Dry Heat (Incineration, Hot air Oven), Filtration (Diatomaceous filters, Membrane filters, HEPA), Radiation (Ionizing radiation-Gamma radiations, non-ionizing radiations-UV radiations); Chemical methods of control: Alcohols, Phenol, Halogens, Heavy metal salts, Quaternary ammonium compounds, Gaseous sterilization agents Compound Microscopy: Parts of Compound microscope, Numerical aperture & its importance, Resolving power, Importance of Oil immersion objective, Ray diagram of compound light microscope; Concept and Importance of electron microscopy.	

Staining: Nature of stains, Types of stains, Principle of simple & Differential staining	
Unit – 4: Microbial Diversity & Viruses	8 hrs
Algae & Fungi: Characteristics & applications in Biotechnology; Archaebacteria: Characteristics, Classification and Applications in Biotechnology; Viruses: General characteristics, Different shapes and symmetries with one example of each type, Classification of viruses on the basis of nucleic acids, Brief idea of lytic cycle and lysogeny.	

Content of Course 2: DSC-2 (Course Code: BBT1T02), Macromolecular Foundations of Biotechnology	**30 Hrs**
Unit – 1: Structural foundations of Macromolecules-1	8 hrs
Carbohydrates: Definition, Classification, Monosaccharide structure and properties. Simple sugars as carbon sources Amino acids and proteins: Definition, Structure, Classification and properties of amino acids, Classification of proteins on the basis of structure (Globular and Fibrous proteins).	
Unit – 2: Structural foundations of Macromolecules-2	8 hrs
Lipids and Fats: Definition, Classification, Structure, properties and importance of lipids. Nucleic Acids: Definition, Classification, Structure of nucleotides, properties and importance of sequence of nucleic acids (DNA and RNA).	
Unit – 3: Macromolecular organization in Bacterial cell	7 Hrs

Carbohydrate, protein and lipid foundations of bacterial cell wall, Comparison of Gram positive and negative cell walls; Macromolecular basis of differential staining techniques (Gram staining, Acid Fast, Endospore and Capsule staining). Phospholipid bilayer as bacterial cell membrane. Proteins as structural and functional cellular units (Transport proteins (porins) and enzymes).	
Unit -4: Nucleic Acids-Blueprint of life	7 hrs
Identifying Deoxyribonucleic Acid (DNA) as the "transforming principle" (Avery, MacLeod and McCarty's Experiment); Beadle and Tatum experiments on Neurospora connecting gene (DNA) to Protein function; DNA protein complexes as Nuclear Materials – Bacterial chromosome structure (its differences with the Eukaryotic chromosome); Extra Chromosomal materials.	

Practical:

Practical 1 (Course Code: BBT1P01)

1. Microbiological laboratory standards and safety protocols.
2. Standard aseptic conditions of Microbiological laboratory.
3. Operation and working principles of Light/ Compound microscope.
4. Working principles and operations of basic equipments of microbiological laboratory (Autoclave, Oven, Incubator, pH meter, Spectrophotometer, Colorimeter, vortex, magnetic stirrer etc).
5. Applications of basic microbiological tools (Pipettes, Micropipette, Bunsen burner, Inoculation loop, Spreader).
6. Qualitative test for carbohydrates: Molisch Test, Benedict's test, Barfoed test, Osazone test
7. Qualitative test for proteins and amino acids: Biuret Test, Ninhydrin Test, Lead Acetate test, Xanthoproteic test
8. Qualitative test for lipids: Solubility test, Saponification test, Acrolein test, Hubl's iodine test, Bromine water test

Practical 2 (Course Code: BBT1P02)

1. Demonstration and observations of microorganisms from natural sources under light microscope (Algae, Yeast and Protozoa).
2. Demonstration of bacterial motility by hanging drop method.
3. Simple staining.
4. Negative staining.
5. Differential staining - Gram staining.
6. Acid fast staining.
7. Structural staining - Flagella and Capsule.
8. Bacterial endospore staining.
9. Staining of reserved food materials.
10. Staining of fungi by Lactophenol cotton blue.

11. Isolation of coliphages from sewage water

Text Books / References

1. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. Basic Microbiology, Avinash Upadhyay, Kakoli Upadhyay & Sunita Bundale 1st edition, 2019, Himalaya Publishing House.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, Pelczar Jr,Chan, Krieg, International ed, McGraw Hill.
8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and Sons Inc., New Jersey 846 pp.
11. Pommerville, J.C. Alcamo's Fundamentals of Microbiology. Jones and Bartlett Pub..Sudburry, 835 pp.
12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655 pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson Education Pte. Ltd., San Francisco. 958pp.
14. Harper's Biochemistry – Murray, Granner, Mayes, and Rodwell – Prentice Hall International Inc.
15. Biochemistry – Lehninger – CBS Publishers.
16. Biochemistry – Stryer – W. H. Freeman & Co. – New York.
17. Text Book of Biochemistry – West, Todd, Mason, Bruggen – Amerind Publishing Co. Pvt., Ltd.

BSc Biotechnology (Hons/Research)

Semester 2

Title of the Courses:

Course 3 BBT2T01: DSC-3 Technical Foundations of Biotechnology

Course 4 BBT2T02: DSC-4 Enzyme Technology

Course 5: Practical DSC-3P BBT2P02

Content of Course 3: DSC-3T, (Course Code: BBT2T03), Technical Foundations of Biotechnology	**30 Hrs**
Unit – 1: Microbiological Techniques	7 Hrs
Pure Culture Methods: Serial dilution and plating methods (pour, spread, streak); Enumeration methods: Turbidity, Cell counting, Colony counting, Maintenance and Preservation of pure cultures; Cultivation of anaerobic bacteria Bacterial identification techniques (Brief concept of Biochemical/ Automated/ Molecular identification methods); Importance of AMR, Mechanism of antimicrobial resistance, Concept of Quorum sensing and AMR screening methods (Antibiotic sensitivity assay method); Concept of MIC, MBC (Broth dilution method and microplate assay)	
Unit – 2: Spectroscopy	8 hrs
Concepts of electromagnetic radiation, Spectrum, Absorption of electromagnetic radiations, Orbital theory, Concept of orbitals & their involvement in absorption of electromagnetic radiations, Concept of chromophores, Beer's law – derivation & deviations, Extinction coefficient; Instrumentation & applications of UV & Visible spectrophotometry	
Unit – 3: Chromatography and Centrifugation	7 hrs

Chromatography: Partition principle, partition coefficient, Nature of partition forces, Paper, Thin layer & Column chromatography (Column efficiency and concept of plates) Gel filtration, Ion-Exchange and Affinity chromatography: Principle and Applications; Brief idea of HPLC and its applications. Centrifugation: Basic principles, Mathematics & theory (RCF, Sedimentation coefficient, Svedberg constant) Types of centrifuge: Desk top, High speed & Ultracentrifuges.	
Unit -4: Electrophoresis	8 hrs
Migration of ions in electric field, Factors affecting electrophoretic mobility; Gel electrophoresis: - Types of gels, Solubilizers, Procedure, Column & slab gels, Detection, Recovery & Estimation of macromolecules, Applications; SDS-PAGE and Agarose Gel Electrophoresis with Applications	

Content of Course 4: DSC-4T (Course Code: BBT2T04), Enzyme Technology	**30 Hrs**
Unit – 1: Proteins as Enzymes	8 Hrs
Protein structure in detail- Structural Organisation of proteins (Primary, Secondary, Tertiary and quaternary structure) Examples of secondary structure of proteins: - The alpha helix, Beta pleated sheet structures; Tertiary structure of proteins: Forces that stabilize the structure, Concept of domains, Quaternary structure of proteins: Subunit interaction; Relevance of protein structural dynamics in enzyme activity.	
Unit -2: Enzyme Structure & Classification	7 hrs

Terminology: Active site, allosteric site, Holoenzyme, apoenzyme, coenzyme, substrate, inhibitor, activator, modulator etc. Classification and nomenclature. Substrate Specificity (bond specificity, group specificity, absolute specificity, stereo-specificity, proof-reading mechanism), lock and key and induced fit models; Concept of allosteric enzymes	
Unit – 3: Introduction to Enzymes in Biotechnology	8 hrs
Restriction enzymes and their classification, Exonucleases and Endonucleases, Ligases, Polymerases, DNA modification enzymes (methylases, demethylases, phosphatases) and Topoisomerases.	
Unit – 4: Modified Enzymes in Biotechnology	7 hrs
Concept of Immobilized enzymes, advantages and applications, Methods of immobilization (Adsorption, covalent coupling, cross-linking, Entrapment/encapsulation) Concept of enzyme engineering- Imparting desired abilities to enzymes, Naturally occurring enzymes with novel properties e.g., Taq Polymerase, its special properties, domain structure, mutants and applications	

Practical:

Practical 1: (Course Code: BBT2P03)

1. Preparation of Solutions: Normal and Molar solutions
2. Calibration of pH meter and determination of pH of natural samples
3. Preparation of Buffer Solutions
4. Separation of amino acids using paper chromatography
5. Colorimetric estimation of Reducing Sugar by DNS method
6. Colorimetric estimation of Proteins by Biuret method
7. Colorimetric estimation of Proteins by Lowry's method

Practical 2: (Course Code: BBT2P04)

1. Bacterial DNA isolation
2. Agarose gel electrophoresis of DNA
3. DNA digestion using Restriction enzymes
4. Determination of bacterial growth by spectrophotometric method & calculation of generation time
5. Isolation of bacteria from air, water, soil
6. Isolation of Pure Culture (Streak Plate, Pour Plate methods)
7. Antibiotic Sensitivity assay

Text Books / References

1. Basic Microbiology, Avinash Upadhyay, Kakoli Upadhyay & Sunita Bundale 1st edition, 2019, Himalaya Publishing House.
2. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
3. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
4. The nature of enzymology – Foster – Croom Helm, London.
5. Fundamentals of enzymology – Price & Stevens – Oxford Science Publ.
6. Principals of enzymology for food science – J. R. Whitkar – M. Dekker Publs.
7. Enzymes – Dixon & Webb – Academic press.
8. Biophysical Chemistry, Principles & Techniques – Upadhyay, Upadhyay & Nath – Himalaya Publ. House.
9. A Biologists Guide to Principle & Techniques of Practical Biochemistry – Williams & Wilson – Edward Ernold Publ.
10. The Tools of Biochemistry – T. G. Cooper.
11. Principles & Techniques of Practical Biochemistry – Wilson, Walker- Cambridge Univ. Press.
12. Physical Biochemistry – H. B. Bull – John Wiley & Sons.
13. Principles of Biochemistry – White, Handler, Smith – McGrew Hill Publ.
14. Biologist's Physical Chemistry – T. G. Morris.
15. Enzyme Technology – Chaplin, Buche – Cambridge Univ. Press.
16. Chromatography – G. Abbott.
17. Methods in Experimental Biology – R. Ralph.
18. Physical biochemistry – van Holde – Prentice Hall Inc.
19. Physical Biochemistry – D. Friefelder – W. H. Freeman & Co.

Open Elective Courses

SEMESTER – I

BIOTECHNOLOGY FOR HUMAN WELFARE

Course Code: BGO1T01 **Total Contact Hours: 30**

Course Outcomes:
After successful completion of this Course, students will be able to:
CO 1. Understand the biotechnological applications in the industry
CO 2. Appreciate application of biotechnology in environmental management
CO 3. Describe application of biotechnology to forensic science
CO 4. Comprehend contributions of biotechnology to biomedical fields, such as diagnostics, genomics and therapeutics
CO 5. Understand the biotechnological applications in the agriculture and livestock management

Unit I **8 hrs**

Environment: Application of biotechnology in environmental aspects: Degradation of organic pollutants – chlorinated and non-chlorinated compounds; degradation of hydrocarbons and agricultural wastes; Biodegradable plastics & Biofuels- production and its futuristic applications; Bioremediation, Biomining

Unit II **7 hrs**

Industry: Important enzymes used in Industries, Biotechnological intervention in enzyme engineering; Industrial production of alcoholic beverages (wine), antibiotics (Penicillin), enzymes (lipase), food supplements (Single Cell Protein), Vitamin (B12). Food processing- Production of cheese and yoghurt

Unit III **8 hrs**

Forensic science: Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques

Health: Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, molecular diagnostics using ELISA, PCR; monoclonal antibodies and their use in cancer; human genome project.

Unit IV **7 hrs**

Agriculture: N_2 fixation: transfer of pest resistance genes to plants; interaction between plants and microbes; biofertilizers & biopesticides.

Livestock: Transgenic animals, animal vaccine production, increased milk production, artificial insemination- poultry, fisheries

References:

• Bhasin M.K. and Nath, S. (2002). Role of Forensic Science in the New Millennium, University of Delhi, Delhi

• Crueger W. and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd Ed., Panima Publishing Co. New Delhi.

• Eckert W.G. (1997) Introduction to Forensic Sciences, 2nd Ed., CRC Press, Boca Raton

• James S.H. and Nordby, J.J. (2005). Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton

• Mohapatra, P.K. (2006) Textbook of Environmental Biotechnology, I.K. International Publishing House Pvt. Ltd., New Delhi

• Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.

• Stanbury P.F, Whitaker A and Hall S.J. (2006). Principles of Fermentation Technology. 2nd Ed., Elsevier Science Ltd.

• Nanda B.B. and Tiwari R.K. (2001). Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi

• Joerdening H.-J. and Winter J. (2005). Environmental Biotechnology – Concepts and Applications

Open Elective Courses

SEMESTER – I

FERMENTED FOODS

Course Code:BGO1T02 **Total Contact Hours: 30**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Understand the importance of fermented foods, probiotics, prebiotics and nutraceuticals.

CO 2. Make the students aware of the different types of beverages.

CO 3. Understand the importance of fermented meat and fish products.

CO 4. Understand the importance of fermented dairy and vegetable products.

Unit I **7 Hours**

History of food fermentations; Types of fermented foods, Nutritional Values, Advantages and Health Benefits; Prebiotics- Sources of prebiotics, Probiotics- Characteristic features, Sources and Microorganisms used as Probiotics; Synbiotics and Nutraceutical Foods; Oriental fermented foods-Soy sauce, Miso, Tempeh, Tofu, Natto; Traditional fermented foods – Idli, Dosa, Khaman

Unit – II **8 Hours**

Beverages- Introduction, Health Importance of Beverages; Ingredients of beverages: Water, fruit pulps, juices, concentrates, sweeteners and preservatives; Alcoholic Beverages- Undistilled Alcoholic Beverages, Beer- commercial production of beer, Elements of brewing process; Types of beer; Wines- commercial production, Types of wine, Distilled alcoholic beverages- Whisky, Rum, Gin, Brandy, Vodka, Non-Alcoholic Beverages- Coffee, Tea, Carbonated beverages, Mocktails, Quality- control in beverage industry

Unit III **7 Hours**

Fermented Meat product Sausages- History of fermented meats industry, Meat composition, Fermentation principles, Meat starter cultures, Manufacture of fermented sausage- Cutting and mixing, Stuffing, Casing materials, Fermentation, Cooking, drying, and smoking, Mold-ripening, Flavour of fermented meats, Defects and spoilage of fermented meats. Fermented fish products- Fish sauces, Fish paste- Manufacturing steps, Storage and Shelf-life of products.

Unit IV **8 Hours**

Fermented Dairy products- Introduction, Cultured dairy products- Yogurt, Cultured buttermilk, Sour cream, Kefir, Other cultured dairy products. Cheese-Introduction, Manufacturing principles, General steps in cheese making, Types of cheese, Cheese ripening, Recent technological advances in cultured dairy products technology. Fermented Vegetable products- Introduction, Production principles, Manufacture of Sauerkraut, Principles of pickle production, fermented olives, Kimchi and Fermented vegetables.

References:

- Hutkins, Robert W. *Microbiology and technology of fermented foods*. John Wiley & Sons, 2008.
- Joshi, V. K. "Biotechnology Food Fermentation" Volume 1. Educational Publishers &Distributors, 2004.
- Hui Y. H "Handbook of Food and Beverage Fermentation Technology". Marcel Dekker, 2004.
- Wood, Brian J. B. "Microbiology of Fermented Foods" Volume 1 and 2. II Edition. BlackieAcademic and Professional, 1998.
- Ramesh C. Ray and Didier Montet, "Fermented Foods, Part- II Technological Interventions",CRC Press, 2017.
- Kosikowski, F.V. 1997. Cheese and fermented milk foods. Frank Kosikowski and Vikram Mistry, Brooktondale, N. Y.
- Feiner, G. 2006. Meat products handbook. ISBN 978-1-84569-050-2
- Industrial Fermentations- Leland, N. Y. Chemical Publishers.
- Prescott and Dunn's- Industrial Microbiology, 4 th, ed.
- Bamforth, C.W. 2004. Beer: Health and Nutrition. Blackwell Science Ltd., Oxford, United Kingdom.

Open Elective Courses

SEMESTER – II

APPLICATIONS OF BIOTECHNOLOGY IN AGRICULTURE

Course Code: BGO2T03 **Total Contact Hours: 30**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Understand the biotechnological applications in agriculture

CO 2. Comprehend the pros and cons of GM crops and their plant products

CO 3. Appreciate the biotechnological applications for effective pest control and crop improvements

CO 4. Understand the importance of molecular markers in agriculture

Unit I **8 hours**

Agricultural Biotechnology: Concept and scope of biotechnology in Agriculture; Plant tissue culture, micro propagation; entrepreneurship in commercial plant tissue culture; Banana tissue culture – primary and secondary commercial setups, Small scale bio enterprises: Mushroom cultivation

Unit II **7 hours**

Transgenic plants: The GM crop debate – safety, ethics, perception and acceptance of GM crops; GM crops case study: Bt cotton, Bt brinjal; Plants as biofactories for molecular pharming; edible vaccines, plantibodies, nutraceuticals.

Unit III **8 hours**

Pest control and crop improvement: Baculovirus pesticides, Mycopesticides; Post-harvest Protection: Antisense RNA technology for extending shelf life of fruits and shelf life of flowers; Genetic engineering for quality improvement: Golden rice, Seed storage proteins, Flavours– capsaicin, vanillin

Unit IV **7 hours**

Molecular marker aided breeding: RFLP maps, linkage analysis, RAPD markers, STS, microsatellite, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), QTL, map based cloning, molecular marker assisted selection

References:

• Chrispeels M.J. and Sadava D.E. (1994) Plants, Genes and Crop Biotechnology, 2nd Ed., Jones and Bartlett Publishers, Boston.

• Gamborg O.L. and Philips G.C. (1998) Plant cell, tissue and organ culture, 2nd Ed., Narosa Publishing House. New Delhi.

• Gistou, P. and Klu, H. (2004). Handbook of Plant Biotechnology (Vol. I & II). John Publication.

• Hammond J., McGarvy P. and Yusibov.V. (2000). Plant Biotechnology, Springer Publ.

• Heldt. H.-W. (1997). Plant Biochemistry and Molecular Biology. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.

• Kyte, L., Kleyn, J., Scoggins, H., and Bridgen M. (2003) Plants from test tubes. An introduction to micropropagation, 4th Ed., Timber Press, Portland.

• Murray D.R. (1996) Advanced methods in plant breeding and biotechnology. Panima Publishing Corporation.

• Nickoloff, J.A. (1995). Methods in molecular biology, Plant cell electroporation and electrofusion protocols-Humana Press Incorp, USA.

• Sawahel, W.A. (1997). Plant genetic transformation technology. Daya Publishing House, Delhi.

Open Elective Courses

SEMESTER – II

BIOETHICS AND BIOSAFETY IN BIOTECHNOLOGY

Course Code: BGO2T04

Total Contact Hours: 30

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Give an insight about the morals and principles while working in the field of biology.

CO 2. Make the students aware of the issues arising per while handling and developing genetically engineered organisms and laboratory animals.

CO 3. Understand the risks involved and the regulations to be followed when experimenting with biological samples.

CO 4. Develop a perception about the practices to be followed in a biotechnology laboratory and the management of the laboratory waste.

UNIT I

7 hours

An introduction to Bioethics; Medical ethics and environmental ethics; Concepts of Bioethics: Autonomy, Justice, Beneficence, Non-Maleficence; Control, resolution, and enforcement of regulations; Ethical committees and constitution

UNIT II

8 hours

Bioethics in health care: patient confidentiality, informed consent, euthanasia, artificial reproductive technologies, prenatal diagnosis, genetic screening, gene therapy, transplantation; Bioethics in research: cloning and stem cell research, Human and animal experimentation, animal rights/welfare; Genetically engineered food, environmental risk, labelling and public opinion

UNIT III

7 hours

Introduction to biosafety and biosecurity; Biological hazards: types; primary containment for biohazards; introduction to biological safety cabinets; Risk assessment: HACCP and management (Assessment, Mitigation and Performance), International Guidelines regarding Biosafety and Biosecurity: OIE, WHO, NIH, CDC

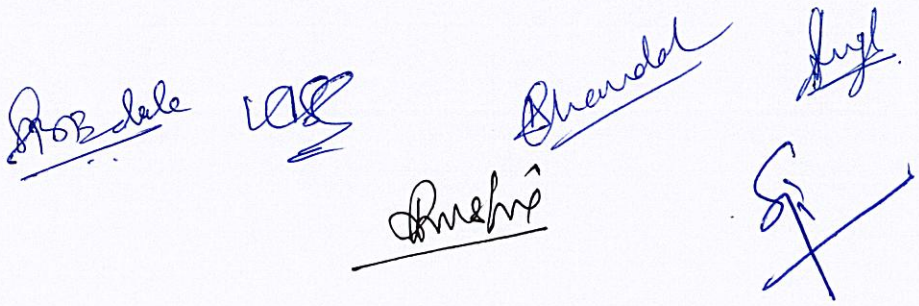
UNIT IV

8 hours

Biosafety Levels: High risk micro-organisms and their management; Good Laboratory Practices (GLPs) and Good Manufacturing Practices (GMPs); Bio-waste Management; Plant biosafety, Principles of safety assessment of transgenic plants – sequential steps in risk assessment

References:

- Kuhse, H. (2010). *Bioethics: an Anthology*. Malden, MA: Blackwell
- Karen F. Greif, Jon F. Merz - Current Controversies in the Biological Sciences_ Case Studies of Policy Challenges from New Technologies (Basic Bioethics)-The MIT Press (2007)
- V. Sreekrishna - Bioethics and Biosafety in Biotechnology-to New Age International Pvt Ltd Publishers (2007)
- Padma Nambisan (Auth.) - An Introduction to Ethical, Safety and Intellectual Property Rights Issues in Biotechnology- Academic Press (2017)
- Kshitij Kumar Singh (auth.) - Biotechnology and Intellectual Property Rights_ Legal and Social Implications-Springer India (2015)
- David Castle - The Role of Intellectual Property Rights in Biotechnology Innovation (2011)
- Goel, D., & Parashar, S. (2013). *IPR, Biosafety and Bioethics*. Pearson Education India.15. Guidelines for Safety Assessment of Foods Derived from Genetically Engineered Plants. 2008.
- Alonso, G. M. (2013). *Safety Assessment of Food and Feed Derived from GM Crops: Using Problem Formulation to Ensure "Fit for Purpose" Risk assessments*



Vocational Skill Courses

SEMESTER – I

BASIC TRANSFORMATION TECHNIQUES

Course Code: BVS1P01 **Total Contact Hours:60**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Get an insight about the principles of bacterial/yeast cell transformation techniques.
CO2. Learn handling and development of genetically engineered organisms in the laboratory.
CO 3. Design strategies to screen genetically modified organisms.
CO 4. Work around the working principles behind various screening strategies

PRACTICALS

1. Bacterial Media preparation and Sterilisation principles for planning a transformation experiment- Eg. LB media preparation and Sterilisation
2. Handling bacterial pure cultures and subculturing- *E. coli* Dh5alpha
3. Pour plate versus Spread plate techniques for obtaining isolated bacterial colonies
4. Plasmid DNA isolation
5. Homogeneity analysis of isolated plasmid DNA by Agarose gel electrophoresis
6. Preparation of competent bacterial cells- $CaCl_2$ Method
7. Cryopreservation of competent cells
8. Transformation of competent bacterial cells with Plasmid DNA containing an antibiotic selection marker- Heat Shock Method
9. Selection of transformed cells using Pour plate/spread plate method
10. Comparison of any two transformation methods of the following to grade transformation efficiency of the methods: Heat Shock, PEG, Microwave, Electroporation, and Ultrasound method.
11. Blue-white screening of bacterial transformants
12. Culture of yeast cells in YPD medium
13. Preparation of competent yeast cells- Lithium Acetate method
14. Yeast transformation using either of the listed gene selection markers- His3, Leu2, Trp1 and Ura3 as selectable marker
15. Positive selection method for screening of yeast transformants-Auxotrophs
16. Negative selection method for screening of yeast transformants- Ura3

References:

1. Sambrook, Joseph, Edward F. Fritsch, and Tom Maniatis. *Molecular cloning: a laboratory manual*. No. Ed. 2. Cold spring harbor laboratory press, 1989.

2. Scarlett, Garry, ed. *DNA Manipulation and Analysis*. Vol. 2633. Springer Nature, 2023.

3. Chang, Donald, ed. *Guide to electroporation and electrofusion*. Academic Press, 1991.

4. Gietz, R. Daniel, and Robin A. Woods. "Yeast transformation by the LiAc/SS Carrier DNA/PEG method." *Yeast Protocol* (2006): 107-120.

5. Das, Surajit, and Hirak Ranjan Dash. *Microbial biotechnology-A laboratory manual for bacterial systems*. Springer, 2014.

6. Gingold, Elliot B. "Bacterial transformation." *Nucleic Acids* (1984): 237-240.

Vocational Skill Courses

SEMESTER – II

DAIRY TECHNOLOGY

Course Code: BVS2P03 **Total Contact Hours:60**

Course Outcomes:

CO 1. This course will help students learn various methods of isolation, detection and identification of spoilage microorganisms in milk.
CO 2. Understand the application of principle of effect of temperature on spoilage of milk products.
CO 3. Develop technician level human resource for dairy industry.
CO 4. Develop young entrepreneurs for self-employment through dairy technology and associated activities.
CO 5. Impart knowledge and technical proficiency in processing of milk, testing and quality control of milk and milk products

PRACTICALS

1. Sampling of milk for physical and chemical examination
2. Determination of Titratable Acidity of Milk
3. Fat test by Gerber's method
4. Tests for Sanitation of Dairy Equipments (Rinse Solution and Swab Contact Methods)
5. Enumeration of total aerobic viable count in raw and pasteurized milk by serial dilution method
6. MBRT of milk samples
7. Resazurin Test
8. Determination of Efficiency of Pasteurization
9. Production of curd by using standard lactic culture and determining acidity.
10. Preparation of Shrikhand/Cheese
11. Preparation of Probiotic food (yoghurt)
12. Isolation of food borne bacteria and fungi from milk products.
13. Molecular identification of food borne bacteria from milk products
14. Effect of temperature on the spoilage of milk products.
15. Detection of Adulterants in milk
16. Detection of preservatives in milk

References:

- Food Microbiology by Frazier 5th ed
- Modern Food Microbiology by James Jay 6th ed
- Applied Dairy Microbiology by Martha & Steele
- Dairy India Year Book. 2007 & 2017. P.R. Gupta Publ., New Delhi.

- Jagadish Prasad, 2002. Principles and practices of Dairy Farm Management, 3rd Ed. Kalyani Publishers, Ludhiana.
- Walstra, P. Wouters, J.T.M. and Geurts, T.J. 2006. Dairy Science and Technology. CRC Press, New York.
- Robinson (1986), Modern Dairy Technology, Vol.I, Advances in Milk Processing, Chapman and Hall India, Madras.
- Fernandes, R.2009 , Microbiology Hand book: Dairy Products. Royal Society of Chemistry, Revised ed., London
- Foster E.M (1957) Dairy Microbiology, Prentice Hall Inc, USA.
- Mani. A., A.M. Selvaraj, L.M. Narayanan, N.Arumugam, Microbiology (General and Applied), Saras Publication, A.R.P. Camp road, Periavilai, Kottar (PO), Nagercoil, Kanyakumari, Dist – 629 002.
- Pelczar.Reid and Chan, 1977 - Microbiology, Tata McGraw-Hill Publishing company Ltd., New Delhi.

Skill Enhancement Courses

SEMESTER – I

DNA MANIPULATION TECHNIQUES

Course Code: BVS1P02 **Total Contact Hours: 60**

Course Outcomes:

After successful completion of this Course, students will be able to:

CO 1. Perform isolation of DNA from different sources

CO 2. Appreciate changes in DNA migratory properties by agarose gel elctrophoresis

CO 3. Describe applications of restriction enzymes in DNA manipulation methods

CO 4. Compare effect of changes in DNA sequence and solution conditions on spectrophotometric properties of DNA

CO 5. Plan and analyse experiments pertaining to DNA manipulations.

PRACTICALS

1. Genomic DNA isolation from Bacteria
2. Genomic DNA isolation from Plant Cells
3. Genomic DNA isolation from Animal Cells
4. Total DNA isolation from soil
5. Check the homogeneity of isolated DNA by Agarose gel electrophoresis
6. Restriction digestion of lambda phage DNA and agarose gel electrophoresis
7. Comparison of different restriction enzyme digests of lambda DNA by agarose gel electrophoresis
8. Melting curve analysis of Lambda DNA
9. Effect of salt concentration on Tm value of lambda DNA
10. Demonstration of southern hybridisation
11. DNA ligase activity analysis by ligation of lambda DNA RE digests
12. Monitoring changes in lambda DNA Tm values on UV irradiation
13. DNA methyltransferase activity assay
14. DNA methylation analysis by restriction fragment analysis
15. DNA methylation quantification by ELISA

References:

1. Sambrook, Joseph, Edward F. Fritsch, and Tom Maniatis. *Molecular cloning: a laboratory manual*. No. Ed. 2. Cold spring harbor laboratory press, 1989.
2. Scarlett, Garry, ed. *DNA Manipulation and Analysis*. Vol. 2633. Springer Nature, 2023.
3. Davis, Leonard. *Basic methods in molecular biology*. Elsevier, 2012.
4. Chawla, H. (2011). *Introduction to plant biotechnology (3/e)*. CRC Press.
5. Doyle, Jeffrey. "DNA protocols for plants." *Molecular techniques in taxonomy* (1991): 283-293.

Skill Enhancement Courses

SEMESTER – II

WINE TECHNOLOGY

Course Code: BVS2P04 **Total Contact Hours: 60**

Course outcomes:

On completion of this course, students will be able to:

CO 1. Demonstrate an understanding of the basic concepts of wine chemistry and wine microbiology
CO 2. Students will be able to learn wine production
CO 3. Students will be able to check quality of grapes and wine
CO 4. Students will be able to evaluate wine quality using chemical and sensory techniques

PRACTICALS

1. Introduction to Wine technology Laboratory and common Wine technology laboratory instruments e.g., Lab fermenter, Refractometer, Hydrometer Colorimeter, pH Meter, Distillation Unit and Chemical Balance
2. Preparation of Malt Extract Glucose Yeast extract Peptone (MGYP) medium for growth & identification of yeast.
3. Isolation of bacteria and yeast from fruits
4. Determination of reducing sugar in molasses sample
5. Identification of grape and wine varieties
6. Preparation of wine from fruits (grapes/apple)
7. Determination of viable count of yeast from fermenting wine sample by Neubaur's chamber
8. Determination of viable count of yeast from fermenting wine sample by Spread plate method.
9. Determination of alcohol content of wine by titrimetric/hydrometer/ specific gravity methods
10. To study the effect of alcohol concentration on yeast growth
11. To learn the techniques of Stem cuttings and its propagation
12. To learn the technique of "Whip" grafting for propagation of grape plants
13. To collect infected fruit samples and study the morphology of major disease causing organisms
14. Sensory evaluation of white wine and red wine.
15. Determination of BOD of given sample(winery/distillery/brewing waste)
16. Determination of COD of given sample(winery/distillery/brewing waste)

Reference Books

1) Casida L. E. (Jr) (1993) Industrial Microbiology, 5th Reprint

2) Frobisher M. (1974)Fundamentals of Microbiology, 9th Edition

3) Patel A. H. Industrial Microbiology.

4) Prescott S. C. and Dunn C.G. (1983) Industrial Microbiology, Reed, g. (Ed.) AVI Tech books.

5) Stanbury P. F., Whitaker A. and Hall S. J., (1997)Principles of Fermentation, 2nd Edition

6)Boltan R. B. (1996) Principles and practice of winemaking, Chapman and Hall.

7)Glaudio Delfins & Formica J. V. (2001) Wine microbiology Science and Technology.

8)The microbial world – Stainer

9). General Microbiology – Volume I and II Power and Daginwala

10) Elements of Microbiology – Pelczar