

ANNEXURE C

FACULTY OF LIFE SCIENCES

SYLLABUS

of

Bachelor of Science (Bio-Technology) Three Year Degree Programme

**Bachelor of Science (Honours) Bio-Technology Four Year Degree
Programme**

(Semester: I-VIII)

(Under Credit Based Continuous Evaluation Grading System)

Batch: 2026-30



**The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)**

Upon successful completion of this course, students will be able to:

PSO1: gain and apply knowledge of biotechnology and science concepts to solve problems related to field of environment and biotechnology.

PSO2: design, perform experiments, analyse, and interpret data for investigating complex problems in the field of biotechnology and allied fields.

PSO3: apply ethical principles and commit to professional ethics and responsibilities and norms of the biotechnological practices.

PSO4: design and develop solution to biotechnology problems by applying appropriate tools while keeping in mind safety factor for environment and society.

PSO5: to undertake any responsibility as an individual and as a team in a multidisciplinary environment.

PSO6: contribute to the biotechnology and allied fields in designing, developing, and providing solutions for product/processes/technology development.

PSO7: able to justify societal, health, safety and legal issues and understand the responsibilities in biotechnological engineering practices.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Batch: 2026-30
Semester-I

Course No.	Course Title	Course Type	Hours per week	Credits	Total Credits	L	P	CA	Total Marks
				L-T-P					
BBTL -1421 BBTL -1031 BBTL -1431	Punjabi (Compulsory) ¹ Basic Punjabi ² Punjab History and Culture	C	4-0-0	4-0-0	4	70	-	30	100
BBTM-1102	Communication Skills in English-I	AEC	3-0-2	3-0-1	4	50	20	30	100
BBTM-1083	Biochemistry-I	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM - 1064	Genetics	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-1345	General Microbiology-I	DSC	3-0-2	3-0-1	4	50	20	30	100
USEP-0001	Entrepreneurship Mindset-I	SEC	0-0-4	0-0-2	2	-	50	-	50
VACF-1491	*Foundation Course	VAAC	2-0-0	2-0-0	2	35	-	15	50
Total Credits					24				

¹ Special Course in lieu of Punjabi (Compulsory)

² Special Course in lieu of Punjabi (Compulsory) for those students who are not domicile of Punjab

*Credits of these papers will not be added towards SGPA/CGPA and only grades will be provided.

C: Compulsory Course

AEC: Ability Enhancement Course

DSC: Discipline Specific Courses

SEC: Skill Enhancement Courses

VAAC: Value Added Audit Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Batch: 2026-30
Semester-II

Course No.	Course Title	Course Type	Hours per week	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL -2421 BBTL -2031 BBTL -2431	Punjabi (Compulsory) ¹ Basic Punjabi ² Punjab History and Culture	C	4-0-0	4-0-0	4	70	-	30	100
BBTM-2102	Communication Skills in English-II	MDC	3-0-2	3-0-1	4	50	20	30	100
BBTM-2483	Cell Biology	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-2084	Biochemistry-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-2345	General Microbiology-II	DSC	3-0-2	3-0-1	4	50	20	30	100
USEP-0002	Entrepreneurship Mindset-II	SEC	0-0-4	0-0-2	2	-	50	-	50
VACD-2161	Drug Abuse and Ethical Education	VAC	4-0-0	4-0-0	4	70	-	30	100
Total Credits					26				

¹ Special Course in lieu of Punjabi (Compulsory)

² Special Course in lieu of Punjabi (Compulsory) for those students who are not domicile of Punjab

C: Compulsory Course

MDC: Multidisciplinary Courses

DSC: Discipline Specific Courses

SEC: Skill Enhancement Courses

VAC: Value Added Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Batch: 2026-30
Semester-III

Course No.	Course Title	Course Type	Hours per week	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTM-3061	Gene Structure and Function	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-3332	Biomathematics and Biostatistics	MDC	3-0-2	3-0-1	4	50	20	30	100
BBTM-3063	Fundamentals of Biotechnology	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-3084	Biochemistry III	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTI-3065	Internship	CCFR	0-0-4	0-0-2	2	-	50	-	50
BBTM-3060	Skill Development in Biotechnology	SEC	3-0-2	3-0-1	4	50	20	30	100
VACE 3221	Environmental Studies	VAC	2-0-0	2-0-0	2	35	-	15	50
Total Credits					24				

DSC: Discipline Specific Courses
MDC: Multidisciplinary Courses
CCFR: Co-curricular Field Work and Report Writing
SEC: Skill Enhancement Course
VAC: Value Added Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Batch: 2026-30
Semester-IV

Course No.	Course Title	Course Type	Hours per week	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTM-4061	Molecular Biology	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-4062	Biochemical and Biophysical Techniques	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-4083	Biochemistry-IV	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-4084	Chemistry	Minor	3-0-2	3-0-1	4	50	20	30	100
BBTM-4485	Zoology	AEC	3-0-2	3-0-1	4	50	20	30	100
VACP-4511	*Personality Development and Gender Sensitization	VAAC	2-0-0	2-0-0	2	35	-	15	50
Total Credits					22				

***Credits of these papers will not be added towards SGPA/CGPA and only grades will be provided.**

DSC: Discipline Specific Courses
AEC: Ability Enhancement Courses
VAAC: Value Added Audit Courses

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
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Batch: 2026-30
Semester-V

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTM-5061	rDNA Technology-I	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-5062	Animal Biotechnology-I	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-5063	Bioprocess Engineering-I	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-5074	Botany-I	MDC	3-0-2	3-0-1	4	50	20	30	20
BBTI-5065	Internship	CCFR	0-0-4	0-0-2	2	-	50	-	50
BBTS-5066	Term paper	DSC	0-0-2	0-0-1	1	-	25	-	25
BBTM-5060	Food and Nutrition	SEC	3-0-2	3-0-1	4	50	20	30	100
VACJ-5551	*Job Readiness	VAAC	2-0-0	2-0-0	2	35	-	15	50
Total Credits					25				

***Credits of these papers will not be added towards SGPA/CGPA and only grades will be provided.**

DSC: Discipline Specific Courses

MDC: Multidisciplinary course

CCFR: Co-curricular Field Work and Report Writing

SEC: Skill Enhancement Courses

VAAC: Value Added Audit Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
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Batch: 2026-30
Semester-VI

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTM-6061	rDNA Technology-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-6062	Animal Biotechnology-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-6063	Bioprocess Engineering-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-6064	Fundamental of Bioinformatics	Minor	3-0-2	3-0-1	4	50	20	30	100
BBTM-6075	Botany-II	AEC	3-0-2	3-0-1	4	50	20	30	100
VACH-6401	Human Rights and Constitutional Duties	VAC	2-0-0	2-0-0	2	35	-	15	50
Total Credits					22				

DSC: Discipline Specific Courses

AEC: Ability Enhancement Courses

VAC: Value Added Course

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Batch: 2026-30
Semester-VII

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL-7111	AI in Biotechnology	Minor	4-0-0	4-0-0	4	70	-	30	100
BBTL-7062	Bio-Entrepreneurship	DSC	4-0-0	4-0-0	4	70	-	30	100
BBTM-7063	Advanced Analytical Techniques	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-7064	Plant Biotechnology-I	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-7065	Immunology-I	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTI-7066	Internship	CCFR	0-0-4	0-0-2	2	-	50	-	50
BBTM-7060	Industrial Biotechnology-I	SEC	3-0-2	3-0-1	4	50	20	30	100
Total Credits					26				

***Credits of these papers will not be added towards SGPA/CGPA and only grades will be provided.**

DSC: Discipline Specific Courses

CCFR: Co-curricular Field Work and Report Writing

SEC: Skill Enhancement Courses

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Batch: 2026-30
Semester-VIII

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTM-8061	Ecology and Evolution	Minor	3-0-2	3-0-1	4	50	20	30	100
BBTM-8062	Plant Biotechnology-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-8063	Research Methodology	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-8064	Immunology-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-8060	Industrial Biotechnology-II	SEC	3-0-2	3-0-1	4	50	20	30	100
Total Credits					20				

DSC: Discipline Specific Courses

SEC: Skill Enhancement Courses

Semester-I

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1083
Course Title: Biochemistry-I
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

CO1: Explain the structure, physicochemical properties, and biological significance of water, pH, buffers, and their role in maintaining biological systems.

CO2: Classify and interpret the structure, properties, and biological functions of carbohydrates and lipids, and relate them to cellular metabolism and physiological processes.

CO3: Analyze the structural organization, classification, and functional significance of proteins, amino acids, and the forces governing protein stability.

CO4: Evaluate the relationship between the structure and function of major biomolecules and their importance in maintaining normal biological functions and metabolic activities.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1083
Course Title: Biochemistry-I
(Theory)

Time: 3 Hours

Max. Marks: 100

L-T-P: 3-0-1

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Water and its properties: role of water in life, Structure of water molecules, Physico-chemical properties of water, Dissociation and association constants, pH and buffers. pI, pKa, Hasselbach Hendersson equation and its implications.

Unit-II

Carbohydrates: Introduction, Biological Importance, Monosaccharides: Families of monosaccharides: aldoses and ketoses, trioses, tetroses, pentoses, and hexoses, epimers, and anomers of glucose. Furanose and pyranose forms of glucose and fructose, Mutarotation, structure and functions of monosaccharide derivatives, Disaccharides; concept of reducing and non-reducing sugars, Haworth projections of maltose, lactose, and sucrose, Structural and functional properties of polysaccharides: storage polysaccharides - starch and glycogen; Structural polysaccharides - cellulose, and chitin; Heteropolysaccharides: Glycosaminoglycans, Peptidoglycan, proteoglycan, glycoproteins

Unit-III

Lipids: Biological importance, Classification of lipids and fatty acids. General structure and function of major lipid subclasses, acylglycerols, phosphoglycerides, sphingolipids, glycosphingolipids and terpenes, sterols, steroids: Prostaglandins.

Unit-IV

Proteins: Biological importance, Structure of amino acids, non-protein and rare amino acids and their chemical reactions. Structural organization of proteins (Primary, Secondary, Tertiary, Quaternary and domain structure), protein classification and function. Forces stabilizing primary, secondary, and tertiary protein structures.

Books Recommended:

1. Heilman, D., Woski, S., Voet, D., Voet, J. G., & Pratt, C. W. (2024). *Fundamentals of Biochemistry*. John Wiley & Sons.
2. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
3. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*. Macmillan Higher Education.
4. Jain, J.L., Jain, S. & Jain, N. (2023). *Fundamentals of Biochemistry*. 9th Edition. S. Chand Publishing.
6. Nelson, D.L. & Cox, M.M. (2021). *Lehninger Principles of Biochemistry*. 8th Edition. W.H. Freeman.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1083
Course Title: Biochemistry-I
(Practical)

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

CO1: Explain the principles of spectrophotometric analysis and biochemical assays used for the qualitative and quantitative estimation of biomolecules.

CO2: Perform biochemical experiments to estimate carbohydrates, proteins, and lipid parameters using standard laboratory techniques.

CO3: Analyze experimental data to determine pKa values, verify Beer-Lambert's law, and differentiate reducing and non-reducing sugars.

CO4: Evaluate the accuracy and reliability of biochemical experimental results using appropriate calculations and laboratory practices.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I**

Batch: 2026-30

Course Code: BBTM-1083

**Course Title: Biochemistry-I
(Practical)**

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Verification of Beer Lamberts Law for p-nitrophenol or cobalt chloride.
2. Determination of pK_A value of p-nitrophenol.
3. Estimation of carbohydrate in given solution by anthrone method.
4. Study the presence of reducing/ non-reducing sugar in biological samples.
5. Protein estimation by Lowry's method.
6. Protein estimation by Bradford method.
7. The determination of acid value of a fat.

Books Recommended:

1. Plummer D (2006) An introduction to Practical Biochemistry. Tata McGraw Hill Publishing Co., New Delhi.
2. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publishing House.
3. Wilson, K. And Walker, J. (2010). Principles and Techniques of Biochemistry, 8th Edition, McGraw Hill Education.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1064
Course Title: Genetics
(Theory)**

COURSE OUTCOMES:

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

CO1: Explain the principles of Mendelian inheritance, gene interactions, linkage, crossing over, mutation, and chromosome organization.

CO2: Apply the principles of classical, microbial, and cytoplasmic genetics to solve problems related to inheritance, recombination, and chromosomal abnormalities.

CO3: Analyze the genetic basis of mutations, chromosomal aberrations, population genetics, and human genetic disorders using appropriate genetic principles.

CO4: Evaluate genetic data using pedigree analysis, karyotyping, and Hardy–Weinberg equilibrium to interpret patterns of inheritance and assess genetic disorders.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I

Batch: 2026-30

Course Code: BBTM-1064

Course Title: Genetics
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit - I

Mendel's Laws of Inheritance: Principle of segregation and independent assortment, Monohybrid, dihybrid, and trihybrid crosses, back cross and test cross, concept of probability

Interaction of Genes: Incomplete inheritance and co-dominance, pleiotropism, modification of F₂ ratios: epistasis, complementary genes, supplementary genes, inhibitory genes, duplicate genes, lethality, and collaborators genes. Multiple allelism.

Unit – II

Linkage: Coupling and repulsion hypothesis, chromosomal theory of linkage, complete and incomplete linkage, linkage groups and significance of linkage.

Crossing Over: Introduction, mechanism of meiotic crossing over, types of crossing over, factors affecting it and its significance.

Mutation: Spontaneous versus induced mutations, types of mutations, mutations rate and frequency, Mutagens: Physical and chemical, the molecular basis of mutations. Significance and practical applications of mutation.

Unit – III

Basic Microbial Genetics: Conjugation, transduction, transformation

Extra Chromosomal (Cytoplasmic) Inheritance: features; inheritance of mitochondrial DNA, chloroplast DNA, kappa articles in Paramecium, Sigma factor in Drosophila, cytoplasmic male sterility (CMS) in maize.

Chromosomal aberrations: Structural: deletion, duplication, inversion, translocation; Numerical: polyploidy, aneuploidy; significance of chromosomal aberrations.

Unit – IV

Organization of Chromosomes: The structure of prokaryotic and eukaryotic chromosome (Macromolecular organization and ultrastructure), karyotype, ideogram, centromere, and telomere structure, significance of telomerase, euchromatin and heterochromatin, Special chromosomes: Polytene chromosomes and lampbrush chromosomes, satellite DNA, supercoiling of DNA.

Human Genetics: Population genetics, Hardy Weinberg law, Pedigree analysis, Karyotyping, genetic disorders.

Books Recommended:

1. Gupta, P.K. (2018). Genetics, 5th Revised Edition, Rastogi Publications.
2. Hartl, D.L. and Jones, E.W., 2019. *Genetics: analysis of genes and genomes*. Jones & Bartlett Learning.
3. Brooker, R.J. (2021). *Genetics: Analysis and Principles*. 7th Edition. McGraw-Hill Education.
4. Snustad and Simmons (2016). Principles of Genetics, 7th Edition, John Wiley & Sons
5. Singh, B.D. (2022). *Genetics*. 6th Revised Edition. Kalyani Publishers.

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Semester-I
Batch: 2026-30
Course Code: BBTM-1064
Course Title: Genetics
(Practical)

COURSE OUTCOMES:

After successful completion of this practical course, the students will be able to:

CO1: Apply the principles of Mendelian genetics and probability to solve numerical problems and demonstrate patterns of inheritance.

CO2: Analyze genetic traits and inheritance patterns using blood group data, dermatoglyphics, and preserved genetic materials.

CO3: Examine chromosomal structures and stages of cell division through microscopic observation of polytene chromosomes and mitotic chromosomes.

CO4: Evaluate genetic observations and experimental data to interpret inheritance patterns and chromosomal behavior using appropriate laboratory techniques.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-27
Course Code: BBTM-1064
Course Title: Genetics
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Demonstration of Law of segregation and independent assortment (use of colored beads, capsules etc.).
2. Numerical problems on Mendelism and on modified F₂ ratios.
3. Numerical problems on paternity disputes (Blood groups)
4. Segregation demonstration in preserved material
5. Study of polytene chromosomes from permanent slides.
6. Dermatographics: Palm print taking and fingertip patterns.
7. Preparation and study of mitosis slides from onion root tips by squash method.

Books Recommended:

1. Caroll, S., Dubley J., Griffiths A.J.F., Wessler, S.R. (2015). An introduction to Genetic Analysis , 11 Edition, WH Freeman.
2. Pierce, B.A. (2020). *Genetics: A Conceptual Approach*. 7th Edition. W.H. Freeman/Macmillan Learning.
3. Singh, B.D. (2022). *Genetics*. 6th Revised Edition. Kalyani Publishers.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1345
Course Title: General Microbiology-I
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

CO1: Explain the evolution, scope, diversity, structure, and significance of microorganisms, including their role in biotechnology and various industrial, agricultural, healthcare, and environmental applications.

CO2: Apply the principles of bacterial classification, staining techniques, microbial cultivation, preservation, nutrition, and sterilization in microbiological studies.

CO3: Analyze the structural, physiological, and nutritional characteristics of microorganisms and the mechanisms involved in microbial growth and nutrient transport.

CO4: Evaluate the principles, applications, and limitations of different microscopic techniques used for the observation and characterization of microorganisms.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1345
Course Title: General Microbiology-I
(Theory)

Time: 3 Hours

Max. Marks: 100

L-T-P: 3-0-1

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Introduction to microbiology- Evolution and scope of microbiology, Historical perspective and important discoveries related to microbiology. Relationship between microbiology and biotechnology- The microbial biotechnology and its applications in various fields such as healthcare, agriculture, industry, and environment, offering diverse career opportunities. The morphology and fine structure of Bacteria, Fungi, Neurospora, Yeast, algae and Viruses (Bacteriophages), Microbes in extreme environments- the thermophiles, halophiles, acidophiles, psychrophiles and alkalophiles.

Unit-II

Gram-positive and Gram-negative bacteria: Introduction, structure and anatomy of bacterial cell walls and nature of the microbial cell surface. Types of bacterial flagella. Different types of bacterial staining. Bacterial classification: Bacterial classification and taxonomy based on Bergey's Manual of Determinative bacteriology– General outline only. An introduction to Bacterial Serotypes.

Unit-III

Microbial culture collection centers, Methods of isolation of pure cultures, Methods of microbial preservation: Refrigeration, cryopreservation, lyophilization, Paraffin method. Basic concept of microbial growth, physiology of microorganisms, culture media and its components, Sterilization-Basic concept, physical and chemical methods of sterilization. Bacterial nutrition-Introduction, nutritional forms of bacteria, Basic concept of transport mechanisms of nutrients across microbial cell membranes: Facilitated diffusion, Active transport and group translocation.

Unit-IV

Principles and application of bright field, dark field, phase contrast, fluorescence and immunofluorescence, electron microscopy (Scanning electron microscopy and transmission electron microscopy).

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore
2. Tortora, G., Tortora, G. J., Funke, B. R., Case, C. L., Weber, D., & Bair, W. B. (2024). *Microbiology: an introduction*.
3. Pelczar, M.J., Chan, E.C.S. & Krieg, N.R. *Microbiology*. 7th Edition. McGraw-Hill.
4. Purohit, S.S. (2006). Microbiology: Fundamentals and Applications, 7th Edition, Agrobios (India).
5. Sherwood, L., Prescott, L. M., Sherwood, L. M., & Woolverton, C. J. (2017). *Prescott's microbiology*. McGraw-Hill Education.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1345
Course Title: General Microbiology-I
(Practical)

COURSE OUTCOMES:

Upon successful completion of this course, the students will be able to:

CO1: Explain microbiology laboratory safety practices, aseptic techniques, sterilization methods, and the functions of common microbiological equipment.

CO2: Perform the preparation, sterilization, isolation, cultivation, purification, and preservation of microorganisms using standard microbiological techniques.

CO3: Analyze the morphological characteristics of bacteria, fungi, yeast, and algae using staining methods and microscopic examination.

CO4: Evaluate microbial cultures based on colony characteristics, staining reactions, and motility tests for their identification and characterization.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM-1345
Course Title: General Microbiology-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Introduction to microbiology laboratory, laboratory safety and common microbiological equipment.
2. Cleaning of glassware and aseptic techniques of sterilization by physical and chemical methods.
3. Preparation of culture media, cotton plugging and its sterilization by autoclaving.
4. Isolation of Microorganisms from Air, Water, and Soil Samples by Serial Dilution, Spread Plate, and Pour Plate Techniques; Observation of Colony Characteristics and Purification of bacterial cultures.
5. Study of the morphology of fungi, yeast, and algae by staining techniques.
6. Identification of bacteria by simple staining, negative staining, and Gram staining.
7. Observation of Bacterial motility by wet mount and hanging drop techniques.
8. Preservation of bacterial cultures by short term preservation methods: Periodic transfer to subculture, Mineral oil overlay, and cryopreservation.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Pearson Education India.
2. Dubey, R. C., & Maheshwari, D. K. (2023). *A textbook of microbiology*. S. Chand Publishing.
3. Leoeffee, M.J. and Pierce, B.E. (2019). Microbiology: Laboratory Theory and Application, 1st Edition, Morton Publishing Company.
4. Sastry, A. S. (2021). *Essentials of Practical Microbiology*. JP Medical Ltd.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: USEP-0001
Course Title: Entrepreneurship Mindset-I
(Practical)

COURSE OUTCOMES:

After studying this course, students will be able to:

CO1: Launch and manage a business by identifying opportunities, developing innovative solutions, and creating a sustainable business model.

CO2: Apply effective marketing and sales strategies using both digital and traditional platforms to acquire and retain customers.

CO3: Analyze financial performance using key business metrics to make informed decisions and ensure business sustainability.

CO4: Scale a business by implementing operational systems, automation tools, and technology-driven solutions for long-term growth.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: USEP-0001
Course Title: Entrepreneurship Mindset-I
(Practical)

Time: 3 Hours

Max. Marks: 50

L-T-P: 0-0-2

Introduction: This course provides students with a holistic framework to develop entrepreneurial skills across the student's journey. The curriculum covers core principles of entrepreneurship, including identifying business opportunities, setting up operations, marketing, scaling, and financial management.

The aim of this course is to ensure that, by the end, learners acquire essential entrepreneurial competencies such as strategic thinking, practical application, founders & growth mindset, operational skills, and foundational financial literacy.

Learning Objectives

By the end of this course, students will be able to:

- Understand and apply entrepreneurial principles to real-world business situations.
- Develop and implement business strategies across different industries.
- Use digital tools, including AI, to enhance and automate business operations.
- Build sustainable business models, manage financials, and scale operations.

Entrepreneurial Specialization Tracks: Skill Development and Business Implementation:

Throughout the program, students will select one of the following five specialized tracks **using the "Punjab Entrepreneurship Mindset Programme" App**, designed to provide a structured pathway for developing entrepreneurial skills and implementing business ventures.

1. E-commerce:

In this track, students will learn how to build, manage, and scale an online business. From setting up an e-commerce platform to managing digital marketing strategies, inventory, and customer experience, this specialization provides the tools needed to succeed in the rapidly growing digital marketplace.

2. Content Creation:

This track focuses on empowering students to create, curate, and market digital content across various platforms. Students will learn how to build a personal or brand identity, develop engaging content, and monetize their platforms, whether through social media, video production, blogging, or influencer marketing.

3. Professional Services:

In this track, students will learn how to capitalize on freelance and contract-based opportunities. They will explore strategies for building a sustainable service-based business, manage client relationships, and maximize the flexibility that comes with this track.

4. Retail Business: This track introduces students to the fundamentals of starting and managing small-scale retail ventures. Learners will discover how to identify in-demand products, source suppliers, set up

shop (physical or home-based), and attract local customers. Emphasis will be placed on practical steps like pricing, promotion, customer service, and building repeat sales to establish a steady income stream.

5. Miscellaneous: This track gives students the freedom to explore unique and diverse business ideas that don't fit into one category. Learners can identify opportunities around them, test simple solutions, and create small ventures based on local needs or personal interests. The focus is on creativity, problem-solving, and learning how to turn everyday ideas into earning opportunities.

The focus is on practical application, with students engaging in real-world projects that culminate in the creation and scaling of a business.

Registration on the APP

For Android Users:

Step 1: Click the following link to download and install the App:

https://drive.google.com/file/d/1zgfoFWN0Y1zWINF_gMpbGvIyeQ10WPM2/view?usp=drivesdk

Step 2: Register by providing your details and generate OTP. (If the OTP is not generated, use the last six digits of your mobile number as the OTP.)

Step 3: Open the tasks and complete them by giving your feedback and attempting the AI-based Quiz.

For iPhone Users:

Step 1: Click on this link:

<https://punjabstartup.com/>

Step 2: Sign up to create an account and generate OTP.

Step 3: Fill in your personal and educational details. After your account is created, open the tasks and complete them by giving your feedback and attempting the AI-based Quiz.

Content Creation

Week / Milestone	Milestone	Description
1	Start your journey as a content creator	Learn how to reach thousands of followers online by creating content.
2	Decide your content topic	Explore different topics and finalize one topic on which you will create content.
3	Start your own content channel	Launch your official channel on YouTube or Instagram and start building your audience.
4	Plan your first week content calendar	Learn how to create a simple weekly content calendar that would keep your audience engaged and make them follow you.
5	Plan and record your first video	Learn how to create a clean and catchy script for your first video and shoot it using your phone.
6	Edit and launch your first video	Learn how to edit your video with trendy music and cool effects and launch your channel with the first video.
7	Reach first 100 followers	Use WhatsApp and your personal Instagram account to tell people about your channel and reach your first 100 followers/subscribers.
8	Master the skill of engaging people with your content	Learn how to connect with your audience so they stay engaged and feel involved.

9	Follow latest trends and famous influencers to grow your channel	Learn how to use trending topics and tag well-known channels or creators to boost your reach and attract more followers.
10	Learn how you can make money from your content	Discover how to do brand deals and promote brands or products your followers truly care about.
11	Make your first partnership	Reach out to 10 brands for partnership and turn one into your first paid deal.
12	Plan your business growth	Create a 1-month plan on what to post weekly to grow your followers and earn money.

E-Commerce

Week / Milestone	Milestone	Description
1	Learn how to start selling online	Learn what an E-commerce business is and how you can start selling online in less than 30 days.
2	Choose your product	Explore different products and finalize what you want to sell online.
3	Find a supplier who will deliver the product for you	Identify suppliers who can send your product directly to the customer and help you launch your E-commerce business.
4	Create your E-commerce store	Make a simple online store using Instamojo and learn how to upload product images and descriptions on the store.
5	Activate payments on your store	Learn how to link your bank account to a payment gateway and integrate it with your Instamojo store to start receiving payments.
6	Launch your online store	Connect your domain name to your Instamojo account, create your launch poster, and officially launch your E-commerce store.
7	Get first 100 people to visit your online store	Learn how to write simple and catchy messages to promote your store and send them to 100 people.
8	Make your first sale	Convert one paying customer and learn how to process the order from beginning to delivery.
9	Create and post your first ad	Learn how to design a simple promotional ad and post it to bring in more people and sales.
10	Take feedback from customers	Engage with your paid customers, take product feedback, and upload success stories or reviews on your website.
11	Get a repeat customer or referral	Build trust with your paid customers to get either a repeat order or a referral.
12	Plan your business growth	Make a 1-month plan to promote and grow your E-commerce store and earn more money.

Professional Service

Week/Milestone	Milestone	Description
1	Start your journey in professional services	Learn what is a service and how you can earn money by offering your skill as a service.
2	Choose your service skill	Choose one skill you are good at and turn it into a service that people will pay for.
3	Find your ideal customer	Talk to people directly or through social media apps to understand who is willing to pay for your service and "WHY".
4	Build your online profile and show what you offer	Explore apps or websites such as WhatsApp Business, Upwork, or Urban Company, and learn how to create an online profile.
5	Write your service description	Learn how to write your service in a simple and powerful way that gets people excited to try it.
6	Finalize your pricing and launch your service	Learn how to set the right price that your customers find fair and launch your service.
7	Get first 100 leads for your service	Learn how to write catchy messages to promote your service in the market and get your first 100 leads.
8	Offer a free service and learn from feedback	Give your service for free to real users and use their feedback to make it better.
9	Make your first sale	Get one paying customer for your service and work really hard to get a 5-star rating and a video testimonial.
10	Build trust with customers and get repeat orders	Use your trust and good relationship with existing customers to get your first repeat customer.
11	Earn your first referral	Start offering bonus or other additional services to your existing customers and get your first referral.
12	Plan your business growth	Make a 1-month plan on how to g

Retail Business

Week/Milestone	Milestone	Description
1	Learn how to start retail business	Understand how retail works, the types of business you can start, and talk to local shops.
2	Choose your product and ideal customer	Look at products in demand in your area and choose what you'll focus on based on your customer needs.

3	Find a supplier for your product	Identify suppliers or wholesalers who can provide quality products/raw materials at good prices.
4	Set up your business	Arrange your shop/home or prepare your products stocked with shopkeepers.
5	Decide product prices and prepare stock	Decide the right selling price, maintain a simple record of sales, and get ready to handle cash or digital payments.
6	Launch your business	Put up posters near your shop and share the announcement with friends, family, and local community groups.
7	Promote your business in your area	Learn simple ways to promote your business locally.
8	Make your first sale	Ensure the buying process is smooth and the customer is happy.
9	Take feedback from customers	Engage with your paid customers and collect product feedback.
10	Discover other platforms to grow your sales	Learn how to set up a free WhatsApp Business account for your shop and collect orders there.
11	Get a repeat customer or referral	Build trust with your paid customers to get either a repeat order or a referral.
12	Plan your business growth	Make a 1-month plan to promote and g

Miscellaneous

Week/Milestone	Milestone	Description
1	Start your journey as an entrepreneur	Learn what entrepreneurship means and how you can start earning by solving problems around you.
2	Identify and validate a real problem to solve	Look around yourself, talk to people, and pick one real problem that many people face.
3	Define your customer and their pain points	Find out who will buy from you, what difficulties they face, and why they need your solution.
4	Generate business ideas and finalize one idea	Think of different ways to solve the problem, compare options, and choose one idea to move ahead with.
5	Define your product or service	Decide clearly what product or service you will provide and how it will solve the customer's problem.
6	Finalize your pricing and launch your business	Set a fair price for your product or service and take the first step to launch your business.
7	Promote your business and get first 100 leads	Tell people about your business using word of mouth, posters, or social media, and collect interest from 100 people.
8	Make your first sale	Get your first paying customer and deliver your

		product or service with full effort.
9	Take feedback from customers and improve	Listen to what customers say after using your product/service and make it better step by step.
10	Build trust with customers and get your first repeat order	Keep your promise, give good quality, and motivate your customer to buy from you again.
11	Earn your first referral and expand your sales	Ask happy customers to recommend you to friends and family so that you can grow your sales.
12	Plan your business growth	Make a simple plan for the next month to get more customers, increase sales, and grow your business.

Evaluation Criteria

The evaluation will be conducted by a committee consisting of the Class Mentor, Nodal Officer, and the Principal/HOD or his/her nominee.

Evaluation Component	Description	Weightage
Weekly Task Completion	Timely submission of weekly tasks, including activities, reflection prompts, graded quizzes, etc.	60%
Target Completion	Performance-based evaluation on achieving revenue or profit targets (e.g., generating ₹10,000 revenue).	20%
Final Project	A comprehensive project based on the semester theme.	20%

Evaluation Mechanism: The score generated by the app will be considered final.

Weekly Component

Each week of the course follows a structured format designed to guide students from learning to doing through simple, practical, and accessible activities.

Component	Duration	Description
Action Lab	~4 hours	- Hands-on task based on the weekly concept. - Includes step-by-step guidance, templates, and worksheets. - Ends with a submission (e.g., video, reflection, or proof of action).
Learning Resources	Self-paced	Videos, short readings, real-life stories, and practical tools to deepen understanding at the learner's own pace.
Check-in	Self-paced	Quizzes and reflection prompts to reinforce learning and monitor progress.

Syllabus Overview for Semester 1–5

Semester	Learning Focus	Learner's Demonstration	Revenue Target
1	Setup & Launch	Understand. Create. Start.	₹10,000

Semester	Learning Focus	Learner's Demonstration	Revenue Target
2	Marketing Basics	Engage. Share. Grow.	₹40,000
3	Operations & Scale	Earn. Deliver. Expand.	₹80,000
4	Organic Growth	Attract. Retain. Build.	₹160,000
5	AI Automation & Finance Mastery	Simplify. Track. Sustain.	₹400,000

Semester 1: Setup & Launch

In Semester 1, students will explore what entrepreneurship means and how it connects to their daily lives. They will learn to identify problems, shape simple business ideas, and test the minimum viable product (MVP). This semester builds the foundation by developing observation skills, value creation, and action-oriented thinking.

Semester 2: Marketing Basics

In Semester 2, students will learn how to attract customers and increase business visibility through digital platforms and community-based marketing strategies. They will also begin running paid advertising campaigns and optimize their marketing efforts using basic analytics.

Semester 3: Operations & Scale

This semester focuses on the day-to-day operations of running a business, including order fulfillment, customer service, logistics, and workflow management. Students will also learn strategies to scale their businesses while effectively managing resources and maintaining quality.

Semester 4: Organic Growth

Students will learn how to grow their businesses organically through referrals, partnerships, customer engagement, and community building. The semester emphasizes developing a loyal customer base and leveraging word-of-mouth marketing to increase reach and credibility.

Semester 5: AI Automation & Finance Mastery

Students will explore AI-powered business tools, automation techniques, and financial management practices. They will learn to automate routine tasks, track business performance using key financial metrics, manage cash flow, and develop sustainable strategies for long-term business growth.

Semester 5: AI Automation & Financial Mastery

The final semester prepares students for long-term business sustainability. Students will integrate AI to improve productivity, automate routine tasks, and enhance decision-making. They will also develop skills in financial planning, including setting income goals, tracking expenses, understanding profit margins, and preparing simple financial forecasts. This semester helps students build a strong entrepreneurial identity while creating systems for financial stability and scalable growth.

Suggested Readings

1. Sinek, Simon. *Start with Why: How Great Leaders Inspire Everyone to Take Action*. Portfolio/Penguin.
2. Ries, Eric. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business.
3. Berger, Jonah. *Contagious: How to Build Word of Mouth in the Digital Age*. Simon & Schuster.

4. Knight, Phil. *Shoe Dog: A Memoir by the Creator of Nike*. Scribner.
5. Fried, Jason, and David Heinemeier Hansson. *Rework: Change the Way You Work Forever*. Crown Business.
6. García, Héctor, and Francesc Miralles. *Ikigai: The Japanese Secret to a Long and Happy Life*. Penguin Books.
7. Ferriss, Tim. *Tools of Titans* (Selected Chapters). Houghton Mifflin Harcourt.
8. Thiel, Peter, and Blake Masters. *Zero to One: Notes on Startups, or How to Build the Future*. Crown Business.
9. Lamba, Anil. *Romancing the Balance Sheet*. Anil Lamba Publications.
10. The Better India / YourStory – Young Entrepreneurs Series (Collection of Articles): Real-life stories of young Indian entrepreneurs and startup journeys that inspire innovation and action.

Semester-II

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Batch: 2026-30
Course Code: BBTM-2084
Couse Title: Biochemistry-II
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the fundamental principles of metabolism, bioenergetics, thermodynamics, ATP-mediated energy transfer, and electron transport mechanisms underlying cellular metabolic processes.

CO2: Analyze the structural organization and biochemical properties of nucleic acids and biologically important nucleotides, and examine their functional significance in cellular metabolism.

CO3: Evaluate the structure, classification, catalytic mechanisms, and regulation of enzymes, and assess the biochemical significance of vitamins as enzyme cofactors in maintaining normal physiological functions.

CO4: Assess the principles of enzyme kinetics, enzyme inhibition, and hormonal regulation, and appraise their roles in metabolic regulation and human health.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme**

Semester-II

Batch: 2026-30

Course Code: BBTM-2084

**Couse Title: Biochemistry-II
(Theory)**

Time: 3 Hours

L-T-P: 3-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Introduction to metabolism, catabolism, anabolism, Laws of Thermodynamics and living system, Free energy change and direction of metabolism, Characteristics of Metabolic pathways, Regulation of metabolic pathways, Compartmentation, and Interorgan metabolism. ATP: Structure, Free energy change, energy coupling with ATP (Creatinine phosphokinase, NDP kinase, Adenylate kinase), metabolic roles of ATP; Energy rich metabolites, biological oxidation – Reduction reactions. Electron transport chain, calculation of ATP during metabolic processes

UNIT-II

Structure of nucleosides and nucleotides, nucleic acid structure – Watson – Crick Model of DNA, structural features of different types of DNA, Nucleic acid chemistry- UV absorption, effect of temperature, acid and alkali on DNA. Structure and functions of biologically important nucleotides as – source of energy, component of coenzymes, second messengers.

UNIT-III

Introduction to Enzymes: Nomenclature, Classification and Characteristics of enzymes, Cofactors, Co-enzyme and Prosthetic group, Mechanism of Enzyme Action: Nature of active site, enzyme substrate complex, Factors responsible for catalytic efficiency of enzymes. Effect of temperature and pH on enzyme activity. Covalent catalysis, Acid base catalysis, Strain and distortion theory, Induced fit hypothesis. Estimation of enzymes such as α -amylase, acid phosphatase, and catalase to demonstrate enzyme function and their response to temperature and pH.

Vitamins: occurrence, biomedical importance, deficiency of fat – soluble vitamins (A, D, E, K) and water-soluble vitamins (Vitamin B complex and Vitamin C), vitamins as cofactors.

UNIT-IV

Enzyme Kinetics: A brief overview of enzyme energetics, Michaelis Menten equation. Derivation of Michaelis Menten equation and determination of K_m and V_{max} values. Enzyme inhibition: Reversible and Irreversible inhibition, Competitive and non-competitive inhibition, Regulation of enzyme activity.

Hormones: Secretory glands, biomedical importance and disorders related with steroid hormones (ovarian, testicular, adrenal cortical and corpus luteal) and peptide hormones (hormones of pancreas, hypophysis, parathyroid, GIT), amino acid hormones (thyroidal, adrenal medullary).

Books Recommended:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry*. Macmillan.
2. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*. Macmillan Higher Education.
3. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
4. J L Jain, Sunjay Jain, Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Batch: 2026-30
Course Code: BBTM-2084
Couse Title: Biochemistry-II
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Explain the principles underlying enzyme assays, enzyme kinetics, and biochemical estimation techniques employed in experimental biochemistry.

CO2: Perform biochemical assays for the estimation of enzyme activities, creatinine, DNA, and RNA using standard laboratory protocols and Good Laboratory Practices (GLP).

CO3: Analyze the effects of pH, temperature, substrate concentration, and inhibitors on enzyme activity by interpreting experimental observations and enzyme kinetic parameters.

CO4: Evaluate experimental data to determine enzyme kinetic parameters and biochemical estimations, and draw scientifically valid conclusions based on the experimental findings.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Batch: 2026-30
Course Code: BBTM-2084
Course Title: Biochemistry-II
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. Estimation of Alpha-amylase activity from saliva.
2. Quantitative estimation of catalase activity in mung beans
3. Effect of pH and temperature on enzyme activity.
4. Determination of K_m for amylase
5. Competitive and non-competitive inhibition
6. To estimate creatinine level in a given sample
7. Estimation of DNA by diphenylamine method
8. Estimation of RNA by orcinol method

Books Recommended:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry*. Macmillan.
2. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*. Macmillan Higher Education.
3. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
4. J L Jain, Sunjay Jain, Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier.
6. Plummer D (2006) An introduction to Practical Biochemistry. Tata McGraw Hill Publishing Co., New Delhi.
7. Sawhney S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publication House, New Delhi.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Batch: 2026-30
Course Code: BBTM 2345
Course Title: General Microbiology-II
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles of microbial growth, growth kinetics, factors influencing microbial growth, and bacterial sporulation in batch and continuous culture systems.

CO2: Analyze the structure, classification, cultivation, and life cycles of plant, animal, and bacterial viruses, including their replication strategies and biological significance.

CO3: Evaluate the interactions between microorganisms and the human host by examining normal microbiota, mechanisms of microbial pathogenicity, host defense systems, and the diagnosis and management of major viral, bacterial, and fungal diseases.

CO4: Assess the role of microorganisms in environmental sustainability through their applications in biomining, bioconversion, bioremediation, and municipal solid waste management.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II**

Batch: 2026-30

Course Code: BBTM 2345

**Course Title: General Microbiology-II
(Theory)**

Time: 3 Hours

Max. marks: 100

L-T-P:3-0-1

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

UNIT-I

Introduction to concept of microbial growth in batch and continuous system. Bacterial generation, doubling time, and specific growth rate. Factors affecting microbial growth: temperature, pH, provision of gases. Monoauxic, diauxic and synchronized growth curve. Sporulation and regeneration of bacteria.

UNIT-II

Viruses-Introduction, plant and animal viruses-structure and composition, classification based on differences in their transcription process. Cultivation of plant and animal viruses. Life cycle Tobacco Mosaic Virus, Herpes simplex and bacteriophages – structure and properties (Lysogenic and Lytic cycle), virioids.

UNIT-III

Normal microflora of human body (skin, oral cavity, respiratory tract, urogenital tract, gastrointestinal tract), Pathogenic microorganisms- Factors contributing towards microbial pathogenicity (adhesion, invasiveness and toxigenicity), Natural resistance and Non-specific defense mechanism against microorganisms.

Introduction, mechanism of action, diagnosis, and treatment for viral diseases – Covid 19, Influenza, AIDS, and hepatitis. Bacterial diseases-Diphtheria, Tuberculosis, Typhoid, Streptococcus, Klebsiella infection. Fungal diseases-Aspergillosis and Candidiasis.

UNIT-IV

Introduction to role of microbes in environment, bio-mining, bioconversion, bioremediation, and municipal solid waste transformations.

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Tortora, G., Tortora, G. J., Funke, B. R., Case, C. L., Weber, D., & Bair, W. B. (2024). *Microbiology: an introduction*.
3. Pelczar, M.J., Chan, E.C.S. & Krieg, N.R. *Microbiology*. **7th Edition**. McGraw-Hill.
4. Sherwood, L., Prescott, L. M., Sherwood, L. M., & Woolverton, C. J. (2017). *Prescott's microbiology*. McGraw-Hill Education.
5. Purohit, S.S. (2006). Microbiology: Fundamentals and Applications, 7th Edition, Agrobios (India).
6. Postgate, J. R. (2000). *Microbes and man*. Cambridge university press.
7. Tortora, G. J., Case, C. L., Weber D., & Funke, B. R. (2024). *Microbiology: an introduction*. 14th edition. San Francisco, CA: Pearson Benjamin Cummings.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: BBTM 2345
Course Title: General Microbiology-II
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Perform microbial enumeration, isolation, and cultivation techniques using standard microbiological methods while adhering to Good Laboratory Practices (GLP) and aseptic techniques.

CO2: Determine microbial growth characteristics by constructing growth curves, calculating generation time, and demonstrating bacterial sporulation using appropriate staining techniques.

CO3: Identify clinically and agriculturally important microorganisms and viral infections through standard diagnostic procedures, including the Germ Tube Test for *Candida albicans* and symptom-based identification of Tobacco Mosaic Virus (TMV).

CO4: Analyze the microbiological quality of environmental samples by performing Standard Plate Count (SPC) and interpreting experimental results for microbial assessment.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II**

Batch: 2026-30

Course Code: BBTM 2345

**Course Title: General Microbiology-II
(Practical)**

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Enumeration of microorganism by Total count and viable count methods.
2. Isolation and Study of Normal Microflora from Hands, Oral Cavity (Tooth-Scum), and Other Body Surfaces.
3. Determination of Growth curve of micro-organisms and Calculation of Generation Time.
4. Study of Sporulation in Bacteria by Endospore Staining
5. Identification of *Candida albicans* by Germ Tube Test.
6. Study of Symptoms of Tobacco Mosaic Virus (TMV) Using Infected Plant Specimens/Charts.
7. Microbiological Analysis of Water by Standard Plate Count (SPC) Method.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Harlow, Addition-Wesley.
2. Sambrook, J. and Russel, D.W. (2012). Molecular Cloning: A laboratory manual 4th Edition, Cold Spring Harbor Laboratory Press, New York.
3. Dubey, R. C., & Maheshwari, D. K. (2023). *A textbook of microbiology*. S. Chand Publishing.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Batch: 2026-30
Course Code: USEP-0002
Course Title: Entrepreneurship Mindset-II
(Practical)

COURSE OUTCOMES:

CO1: Launch and manage a business within their chosen entrepreneurial track by applying fundamental business concepts and strategies.

CO2: Identify profitable business opportunities, develop innovative solutions, and implement effective marketing and sales strategies using digital and traditional methods.

CO3: Apply financial management techniques to monitor business performance, analyze financial metrics, and make informed business decisions.

CO4: Scale and sustain a business by leveraging operational systems, automation tools, and AI-driven solutions for improved productivity and long-term growth.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I**

Batch: 2026-30

Course Code: USEP-0002

**Course Title: Entrepreneurship Mindset-II
(Practical)**

Time: 3 Hours

Max. Marks: 50

L-T-P: 0-0-2

INTRODUCTION

This semester helps learners understand marketing as a practical life skill- not just “advertising.” It teaches them how to communicate value, attract the right customers, and grow something small into something sustainable. Learners explore the basics of customer psychology, messaging, content creation, and simple sales strategies. Through hands-on activities, they will practice real marketing techniques for their micro-hustle or a simulated business idea, learning how to get attention, build trust, and generate sales.

Learners Objective

- Understand the core concepts of marketing using simple, relatable real-world examples.
- Learn how customers think, choose, and buy—and how businesses influence decisions ethically.
- Identify and define a target customer clearly instead of “selling to everyone.”
- Create clear messaging: what they sell, who it helps, and why it matters.
- Use basic marketing channels (offline + online) to attract customers.
- Run a simple marketing campaign and measure what worked.
- Build confidence in selling, promoting, and talking about their product/service.

Outcome

By the end of this semester, learners will be able to market a product/service using basic strategies, attract real customers, and improve their results through feedback and experimentation.

Guiding Principles/Approach

This syllabus is built on action-based learning, clarity-first communication, and customer first thinking. Learners don’t just study marketing- they practice it in real situations through small experiments and repeated improvement. The course is designed to feel approachable and practical: learners create simple content, test messaging, talk to real people, and observe what influences decisions.

Instead of heavy theory, students build marketing skills through doing: customer discovery, storytelling, channel experiments, and reflection. The curriculum emphasizes confidence building, ethical marketing, and communication as a leadership skill. By helping learners see results quickly (even small wins like one customer or one inquiry), the program builds motivation, creativity, and real-world business readiness.

Recap Milestone

The recap milestone focuses on revising all the 12 milestones of semester 1 and also helps students understand the upcoming 12 milestones journey of semester 2.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
Recap	Recap and Introduction	Revise what you learned in Semester 1 and plan what you will do in Semester 2.	1	Revise first 12 milestones of Semester 1	• Watch a video on "Semester 1 Summary" • Download the 12 summary cards of Semester 1 milestones. • Write 3 key learnings from Semester 1. • Write 3 things you will improve in Semester 2 • Attempt the Semester 1 Recap Quiz.
		Revise what you learned in Semester 1 and plan what you will do in Semester 2.	2	Set your goals for Semester 2	• Learn how to 4X your revenue in Semester 2 using marketing • Read how famous brands use marketing to increase revenue • Set your marketing goals • Attempt the Semester 2 Readiness Quiz.

Milestone 13:

Marketing Fundamentals Marketing Fundamentals milestone focuses on helping students understand the basics of marketing and how they can use marketing to scale their businesses and generate revenue.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
13	Learn marketing	Learn how you can	1	Understand	• Watch a video on

	fundamentals to scale your business	use multiple types of marketing to scale your business and grow your revenue.		what is marketing	marketing fundamentals. • Read examples of famous marketing campaigns in India • Explain what you learned about marketing • Attempt Task 01 Quiz.
			2	Learn different types of digital marketing	• Watch a video on what is digital marketing. • Read a document on types of digital marketing. • Write what kind of digital marketing works best for your business and why • Attempt Task 02 Quiz.
			3	Write 3 marketing ideas for your business	• Read a document on how businesses like yours are using marketing to generate revenue • Write three marketing ideas to scale your business • Validate your ideas with 3–5 people • Shortlist the best idea and explain how it will generate revenue • Share your experience of completing this milestone • Attempt Task 03 Quiz.

Milestone 14: WhatsApp/ Community Marketing

WhatsApp/Community Marketing milestone focuses on helping students learn how to build a WhatsApp community for their users and use it to generate trust, engagement, and sales.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
14	Build and activate your WhatsApp community	Build a WhatsApp community for your users and use it to generate trust, engagement, and sales.	1	Create your WhatsApp community	• Watch a video on why you should build a WhatsApp community. • Read a document on how to create a WhatsApp community • Enter the name of your community. • Upload your WhatsApp community link • Attempt Task 01 Quiz.
			2	Invite people to join your WhatsApp community	• Read a few sample invite and welcome messages • Draft an invite message to invite 50 people to join your community • Draft a welcome message for your community members • Upload a screenshot of your welcome message. • Attempt Task 02 Quiz.
			3	Engage your community users and start building trust	• Learn how to engage people in your community • Read the top 10 community engagement ideas for your business • Write 5 types of content to post weekly in your community • Create and upload your weekly content calendar. • Attempt Task 03 Quiz.
			4	Get 3 sales from your WhatsApp Community	• Learn how to do soft-selling in your community • Create a community-only offer • Learn how to convert interested people into paid customers. • Write a simple plan to generate 3 sales per month from the community

					• Share your experience of completing this milestone. • Attempt Task 04 Quiz.
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Milestone 15: Generating Content for Marketing using AI

AI-led Content creation and marketing milestone focuses on helping students learn how to use AI tools to generate creative ideas and create professional videos, posters, and blogs.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
15	Use AI to generate content for marketing	Learn how to use AI tools to generate creative ideas and create professional videos, posters, and blogs.	1	Learn what is content marketing	• Watch a video on <i>What is Content Marketing</i>. • Learn which content works for brand awareness or revenue generation • Write three types of content you believe your customers like • Attempt Task 01 Quiz.
			2	Generate content ideas to attract customers	• Learn how to use AI to generate content marketing ideas for your business. • Generate 10 small content ideas to attract your customers • Discuss the ideas with your users and take feedback • Shortlist the three best content ideas to attract customers. • Attempt Task 02 Quiz.
			3	Create your first brand video using AI	• Watch a video on <i>How to Use AI Tools to Create Simple Short Videos</i> • Read a guide on how to ask AI to write a video script • Generate five ideas for your AI videos and write them here • Upload your AI-generated video link. • Attempt Task 03 Quiz.
			4	Create a brand poster using AI	• Learn how to create a poster using AI • Write a prompt for the poster you will create using AI • Upload the AI poster you have

					created .• Post the poster in your WhatsApp community .• Attempt Task 04 Quiz.
			5	Write a blog using AI	.• Learn how to use prompt engineering to write content for your business .• Read a list of topics on which you can write a blog .• Write the topic on which you will write a short blog .• Write the first version of your blog. .• Share your blog with your friends and faculty .• Share your experience of completing this milestone .• Attempt Task 05 Quiz.

Milestone 16: Social Media Marketing

Social Media Marketing milestone focuses on helping students learn what social media marketing is and how to create a social media weekly plan that engages users and improves brand visibility.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
16	Plan your social media marketing strategy	Learn what social media marketing is and how you can use it to scale your business.	1	Learn what is social media marketing	.• Watch a video on <i>Introduction to Social Media Marketing</i> . .• Learn different types of social media marketing .• Read a document on how to use social media marketing to generate revenue .• Write your understanding of social media marketing .• Write one social media marketing idea for your business .• Attempt Task 01 Quiz.
			2	Research your competitors	.• Learn how to research your competitors .• Find your competitors .• Write the three things your competitors are posting .• Find one unique gap that you can capture .• Attempt Task 02 Quiz.
			3	Finalize	.• Watch a video on <i>What are</i>

				your content pillars	<i>Content Pillars?</i> • Read examples of content pillars • Write five content pillars for your social media strategy • Attempt Task 03 Quiz.
			4	Create your weekly social media plan	• Watch a video on <i>How to Create a Weekly Social Media Plan</i>. • Look at examples of social media calendars • Create and upload your weekly calendar • Upload the link to your Instagram Channel • Share your experience of completing this milestone. • Attempt Task 04 Quiz.

Milestone 17: Trust-led Marketing

Trust-led Marketing milestone focuses on helping students build trust through social media proofs, testimonials, or basic engagement and later converting them into leads and sales.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
17	Generate leads and turn them into sales	Use testimonials, conversations, and daily posts to generate leads and close sales.	1	Use social proof to build trust	• Identify 2 happy customers • Create a testimonial post with a call-to-action (CTA) • Post the testimonial on social media. • Post the testimonial in the community • Attempt Task 01 Quiz.
			2	Make people share their problems	• Learn how to ask open-ended questions • List 5 customer problems • Post these problems in the community and on social media. • Evaluate the top 2 problems customers face • Encourage people to share their problems • Attempt Task 02 Quiz.

			3	Help your users with a 3–5 days content sprint and generate leads	• Brainstorm or use AI to create a solution document for each problem • Post one solution daily for 3–5 days • Send direct messages (DMs) to check if your solution is helping them. • Write how many leads you generated • Attempt Task 03 Quiz.
			4	Convert leads into sales	• Learn how to convert leads into sales • Soft-sell your offering in the community and on social media • DM people explaining how your product can help them better. • Follow up after 24–48 hours. • Write how many leads you converted into sales • Share your experience of completing this milestone • Attempt Task 04 Quiz.

Milestone 18: Viral/Trend Marketing

Viral Marketing milestone focuses on helping students learn how to launch viral campaigns for their businesses using the latest trends and make their brand go viral without spending any money.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
18	Make your brand go viral	Design viral marketing campaigns to reach 5X users without spending any money.	1	Learn viral marketing	• Understand what virality is and how it works • Read about the top 10 viral marketing campaigns in India • Write three reasons why people share content • Attempt Task 01 Quiz.
			2	Design 2 viral campaigns for your business	• Learn five types of common viral marketing strategies • Read 10 viral marketing ideas for your business

					• Design two viral campaigns for your business • Take feedback from people and finalize one campaign. • Set your campaign targets • Attempt Task 02 Quiz.
			3	Launch one viral campaign to increase customer reach	• Create your campaign launch video or poster • Create your campaign launch message • Launch your campaign on your social media platform • Launch your campaign in your WhatsApp community • Attempt Task 03 Quiz.
			4	Promote your campaign to make it viral	• Share your campaign in other groups and forums. • Measure your campaign performance • Learn how to improve your campaign • Analyze your campaign and record final metrics • Enter the summary of your campaign. • Share your experience of completing this milestone. • Attempt Task 04 Quiz.

Milestone 19: BTL/Offline Marketing

BTL/Offline Marketing milestone focuses on helping users learn about BTL(below the line) or offline marketing and use it to reach out to local customers and generate revenue.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
18	Make your brand go viral	Design viral marketing campaigns to reach 5X users without	1	Learn viral marketing	• Understand what virality is and how it works. • Read about the top 10 viral marketing campaigns in India • Write three reasons why people

		spending any money.			share content. • Attempt Task 01 Quiz.
			2	Design 2 viral campaigns for your business	• Learn five types of common viral marketing strategies • Read 10 viral marketing ideas for your business • Design two viral campaigns for your business • Take feedback from people and finalize one campaign • Set your campaign targets • Attempt Task 02 Quiz.
			3	Launch one viral campaign to increase customer reach	• Create your campaign launch video or poster • Create your campaign launch message • Launch your campaign on your social media platform • Launch your campaign in your WhatsApp community • Attempt Task 03 Quiz.
			4	Promote your campaign to make it viral	• Share your campaign in other groups and forums • Measure your campaign performance • Learn how to improve your campaign • Analyze your campaign and record final metrics • Enter the summary of your campaign • Share your experience of completing this milestone • Attempt Task 04 Quiz.

Milestone 20: Collaboration and Affiliate Marketing

Collaboration and Affiliate Marketing milestone focuses on helping users learn about affiliate marketing and how to collaborate with individuals/businesses to reach more customers and generate revenue.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
20	Grow through collaboration and affiliation	Use partners and affiliates to reach new	1	Understand affiliate marketing and	• Watch a video on what affiliate marketing is.

	marketing	audiences and generate sales.		collaboration	• Read about top collaboration or affiliate marketing campaigns .• Learn 10 common types of collaboration or affiliate marketing for your business .• Pick three types that can work for your business .• Attempt Task 01 Quiz.
			2	Design your affiliation model	• Learn how to start an affiliation program. • Decide your commission structure. • Write a pitch for partnership .• Attempt Task 03 Quiz.
			3	Finalize one person or business for collaboration	• Learn how to find the right partner for collaboration .• Create a list of 5–10 people or businesses for collaboration. • Send your partnership pitch to potential partners .• Write the name of one final partner .• Attempt Task 03 Quiz.
			4	Execute the collaboration	• Explain how the partner will market your brand. • Post the link or screenshot of successful collaboration. • Respond to new leads within 24 hours

					• Close at least one sale • Attempt Task 04 Quiz.
			5	Measure your collaboration	• Write the number of leads generated • Write the number of sales closed and revenue generated • Write what worked and how to improve the collaboration • Share your experience of completing this milestone • Attempt Task 05 Quiz.

Milestone 21: Advertising Marketing (Meta)

Advertising Marketing milestone focuses on helping users learn how to post a paid ad on Meta (Instagram and Facebook) promoting their business and reach to more users or generate revenue.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
21	Run your first ad on Instagram	Learn how to boost posts or run simple video ads to reach new viewers.	1	Setup your Meta Business Suite	• Watch a video on why to run ads on Meta. • Learn different types of ads. • Read the guide on Meta Ad Account setup • Set up your Meta Ad Account. • Attempt Task 01 Quiz.
			2	Design your first paid ad	• Watch samples of good ad designs for your business • Finalize your ad objective • Upload the final draft of your ad with final copy and creatives • Attempt Task 02 Quiz.
			3	Define your target audience	• Watch a video on how to target the right people for

				and budget	your ad. • Define your target audience .• Learn how to decide the right budget for your ad .• Decide your final budget .• Attempt Task 03 Quiz.
			4	Launch your ad	• Learn how to create and launch your ad. • Create your ad and review the preview .• Upload the screenshot of the launched ad. • Attempt Task 04 Quiz.
			5	Manage incoming leads from ad	• Draft a message for incoming leads .• Send draft messages to leads within 24 hours. • Pitch your offer to leads and follow up. • Close at least one sale .• Attempt Task 05 Quiz.
			6	Measure your ad performance	• Learn metrics to measure ad performance. • Write the money spent and the number of leads or impressions .• Mention CPL or CPM .• Write the revenue generated and the number of sales closed .• Write what worked and how to improve future ads .• Share your experience of completing this milestone. • Attempt Task 06 Quiz.

Milestone 22: Psychological Marketing

Psychological Marketing milestone focuses on helping users identify psychological triggers like urgency, pricing, and offers, and use them to increase conversions and revenue.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
22	Use	Learn how to	1	Understand	• Learn why people buy

	Psychological Triggers to Increase Sales	use urgency, pricing, and offers to increase conversions and revenue.		the psychological triggers	products .• Share a story of one product you purchased because of a trigger .• Identify buying triggers for your business. • Attempt Task 01 Quiz.
			2	Execute FOMO or urgency marketing	• Learn how to create a FOMO or urgency marketing campaign .• Write how you will create FOMO or urgency for your customers .• Create one FOMO/urgency marketing campaign .• Launch your campaign on social media and in your community. • Attempt Task 02 Quiz.
			3	Execute one offer or discount marketing campaign	• Learn how to create offer or discount marketing campaigns .• Write how you will create an offer/discount campaign. • Create one offer/discount campaign for your customers .• Launch your campaign on social media and in your community .• Share your experience of completing this milestone .• Attempt Task 03 Quiz.

Milestone 23: Data-Driven Marketing

Data-Driven Marketing milestone focuses on helping users analyze the data of the last 10 milestones and run specific campaigns or ideas that resulted in lead generation or revenue.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
23	Use Data-Driven Marketing to Grow Faster	Analyze data of the last 10 milestones to identify top campaigns or ideas and decide what to continue, improve, or stop.	1	Analyze your marketing data	Learn how businesses make decisions using data
			2	Re-execute top performing campaign	List 3 things that worked well and why
					List 3 things that didn't work well and why
					Attempt task 01 quiz
					Re-execute top 1–2

					campaigns for 1 week
					Write how it helped generate leads or revenue
					Attempt task 02 quiz
			3	Improve one low-performing campaign and relaunch it	Pick one low-performing campaign and write how to improve it
					Improve the campaign and relaunch it
					Measure its performance and see if it was better
					Share your experience of doing this milestone
					Attempt task 03 quiz

Milestone 24: Closure and Next Step

The final milestone focuses on helping users reflect on their learnings and also create an action plan for the next few months to continue to scale and grow their business.

Milestone #	Milestone Name	Milestone Description	Task #	Task Title	Activity Title
24	Plan your next growth phase	Document your 12 weeks of learning and create a 1 month plan to scale and grow your business.	1	Review your progress	List all the ideas you executed
					Write which milestone helped you the most and how
					Write which milestone helped you the least and why
					Write your key learnings from this semester
					Create a not-to-do list for your business
					Attempt task 01 quiz
			2	Create your 1 month marketing plan	Learn how to create a 1 month marketing plan
					Set your marketing goal
					Create and upload your 1 month plan to achieve this goal

					Share your experience of doing this milestone
					Attempt final semester quiz

Evaluation Criteria

The evaluation will be conducted by a committee consisting of the class mentor, nodal officer, and the principal HOD or his/her nominee.

Evaluation Component	Description	Weightage
Weekly Task Completion	Timely submission of weekly tasks, including activities, reflection prompts, graded quizzes, etc.	60%
Target Completion	Performance-based evaluation on hitting revenue or profit targets (e.g., generating ₹10,000 revenue).	20%
Final Project	A comprehensive project depending on the theme of the semester.	20%

Evaluation Mechanism

The score generated by the app will be final.

Weekly Component

Each week of the course follows a structured format designed to guide students from learning to doing, using simple, mobile-accessible components:

Component	Duration	Description
Action Lab	~4 hrs	- Hands-on task on the weekly concept. - Includes step-by-step guidance, templates, and worksheets. - Ends with a submission (e.g., video, reflection, or proof of action).
Learning Resources	Self-paced	- Videos, short readings, real-life stories, and tools to deepen understanding at their own pace.
Check-in	Self-paced	- Quizzes & Reflection prompts

Syllabus Overview for Semester 1–5

Semester	Learning Focus	Learner's Demonstration	Revenue Target
1	Setup & Launch	Understand. Create. Start.	₹10,000/-

2	Marketing Basics	Engage. Share. Grow.	₹40,000/-
3	Operations & Scale	Earn. Deliver. Expand.	₹80,000/-
4	Organic Growth	Attract. Retain. Build.	₹160,000/-
5	AI Automation & Finance Mastery	Simplify. Track. Sustain.	₹400,000/-

Semester 1: Setup & Launch

In Term 1, students will explore what entrepreneurship means and how it connects to their daily lives. They will learn to identify problems, shape simple business ideas, and test the mineral settings. This semester builds the foundation—mindset, observation, value creation, and action.

Semester 2: Marketing Basics

In Term 2, students will learn how to attract customers and grow their visibility using digital platforms and community-based marketing strategies. Students will also begin to run paid advertising campaigns and learn how to optimize their marketing efforts.

Semester 3: Operations & Scale

This semester focuses on the day-to-day operations of running a business, including order fulfillment, customer service, and logistics. Students will also focus on scaling operations as demand grows, with an emphasis on managing resources effectively.

Semester 4: Organic Growth

Students will learn how to grow their businesses organically, using referrals, partnerships, and community engagement. This semester focuses on building a loyal customer base and using word-of-mouth marketing to increase reach and credibility.

Semester 5: AI Automation & Financial Mastery

The final semester prepares students for long-term sustainability. Students integrate AI to improve productivity, automate routine tasks, and enhance decision-making. They also dive deep into financial planning, learning to set income goals, track expenses, understand profit margins, and create simple financial forecasts. This semester helps students solidify their entrepreneurial identity design systems for financial stability and scalability.

Books recommended:

1. Simon Sinek, *Start with Why: How Great Leaders Inspire Everyone to Take Action*, Portfolio/Penguin
2. Eric Ries, *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*, Crown Business
3. Jonah Berger, *Contagious: How to Build Word of Mouth in the Digital Age*, Simon & Schuster
4. Phil Knight, *Shoe Dog: A Memoir by the Creator of Nike*, Scribner

5. Jason Fried and David Heinemeier Hansson, *Rework: Change the Way You Work Forever*, Crown Business
6. Héctor García and Francesc Miralles, *Ikigai: The Japanese Secret to a Long and Happy Life*, Penguin Books
7. Tim Ferriss, *Tools of Titans (Selected Chapters)*, Houghton Mifflin Harcourt
8. Peter Thiel and Blake Masters, *Zero to One: Notes on Startups, or How to Build the Future*, Crown Business
9. Anil Lamba, *Romancing the Balance Sheet*, Anil Lamba Publications
10. The Better India/Your Story, *Young Entrepreneurs Series* (Collection of Articles) – Real Indian stories of youth starting businesses, snackable reads that show what's possible.

Semester-III

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3061
Couse Title: Gene Structure and Function
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Describe the molecular organization of DNA and RNA, gene architecture, regulatory elements, mechanisms of DNA replication, and the concepts of genome size and genome complexity in prokaryotic and eukaryotic organisms.

CO2: Analyze the molecular mechanisms of transcription and the structure–function relationship of different RNA molecules, and examine the classification, characteristics, and applications of transposable elements in prokaryotic and eukaryotic genomes

CO3: Evaluate the regulatory mechanisms governing gene expression in prokaryotic and eukaryotic systems, with special emphasis on operon models and molecular control of transcription.

CO4: Assess the molecular basis of oncogenesis, tumour suppressor genes, DNA repair mechanisms, and the scientific significance of the Human Genome Project in advancing genomics, precision medicine, and biotechnology research.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme**

Semester-III

Batch: 2026-30

Course Code: BBTM-3061

**Couse Title: Gene Structure and Function
(Theory)**

Time: 3 Hours

L-T-P: 3-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Molecular basis of life: DNA and RNA. ultra structure of prokaryotic and Eukaryotic gene and their regulatory elements (promoter, operator, silencer, enhancer, 5' and 3' UTR's), DNA replication; types of replication (conservative, semiconservative and dispersive), Meselson and Stahl experiment of replication, overview of components and mechanism of replication in prokaryotes and eukaryotes, Genome size and Genome complexity: C value and C value paradox, pseudogenes, intergenic sequences, satellite and repetitive DNA.

UNIT-II

Structure of different types of RNA and their function, transcription process in prokaryotes and eukaryotes (transcription factors, RNA polymerases, formation of initiation, complex, elongation and termination),

Transposable elements (TEs): characteristic of transposable elements, Types of transposable elements: Insertion sequences and transposons- Class I- retrotransposons, LINE and SINE and Class II-DNA Transposons, Autonomous and non-autonomous transposons, Bacterial transposons- composite and non-composite mobile genetic elements, applications of transposable elements.

UNIT-III

Regulation of gene expression in prokaryotes: Lac operon, Repressible model- Negative regulation of lac operon by lactose, Inducible- positive regulation of lac operon: Induction and catabolite activator, mechanism and control of Tryptophan and Histidine operon, levels of gene regulation in eukaryotes

UNIT-IV

Genes playing role in cancer development: protooncogenes, activation of oncogenes, inactivation of tumor suppressor genes (function and mechanism of action of p53) and DNA repair genes, Human Genome Project (HGP): Phases, Principle and goals of Human Genome project, and outcome of HGP

Books recommended:

1. Lodish, H. F., Berk, A., Kaiser, C., Krieger, M., Bretscher, A., Ploegh, H. L., Martin, K.C., Yaffe, M.B. and Amon, A. (2021). *Molecular cell biology* (Vol. 1). New York: WH Freeman.
2. Krebs, J. E., Lewin, B., Goldstein, E. S., & Kilpatrick, S. T. (2013). *Lewin's essential genes*. Jones & Bartlett Publishers.
3. Nelson, D.L. & Cox, M.M. (2021). *Lehninger Principles of Biochemistry*. 8th Edition. W.H. Freeman.
4. Freifelder, D. (2013). *Microbial Genetics*, Narosa Publishing House.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3061
Course Title: Gene Structure and Function
(Practical)**

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Perform the isolation of plant genomic DNA and evaluate its quality and purity using UV–Visible spectrophotometric analysis.

CO2: Operate UV–Visible spectrophotometric techniques to determine the concentration, absorption characteristics, and purity of nucleic acid samples.

CO3: Demonstrate the principles and applications of Native PAGE and SDS-PAGE for the separation and analysis of proteins.

CO4: Analyze genomic sequences using bioinformatics tools to identify open reading frames (ORFs) and exon–intron organization for gene structure annotation and interpretation.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3061
Couse Title: Gene Structure and Function
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. Extraction of plant Genomic DNA
2. Determination of absorption spectra of DNA and RNA using UV-Vis Spectrophotometer and determine purity of DNA and RNA sample.
3. To study proteins by Native PAGE
4. To study proteins by SDS PAGE
5. a. To deduce ORF from genomic DNA using different ORF Finder Tools, PlasMappe 3.0.
b. To determine intron exon boundaries using Gene Structure Display Server.

(<https://gsds.gao-lab.org/>)

Books recommended:

- 1.Lodish, H. F., Berk, A., Kaiser, C., Krieger, M., Bretscher, A., Ploegh, H. L., Martin, K.C., Yaffe, M.B. and Amon, A. (2021). *Molecular cell biology* (Vol. 1). New York: WH Freeman.
- 2.Bolsover, S.R., Hyams, J.S., S. Shephard, E.A. and White H.A. (1997) *From Genes to Cells*, John Wiley and Sons.
- 3.Krebs, J. E., Lewin, B., Goldstein, E. S., & Kilpatrick, S. T. (2013). *Lewin's essential genes*. Jones & Bartlett Publishers.
- 4.Nelson, D.L. & Cox, M.M. (2021). *Lehninger Principles of Biochemistry*. 8th Edition. W.H. Freeman.
- 5.Freifelder, D. (2013). *Microbial Genetics*, Narosa Publishing House.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3063
Course Title: Fundamental of Biotechnology
(Theory)

COURSE OUTCOMES

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

CO1: Describe the historical evolution, scope, fundamental concepts, model organisms, and the role of biotechnology research, institutions, and career opportunities in India.

CO2: Analyze the principles and applications of biotechnology in healthcare, agriculture, food production, environmental sustainability, molecular diagnostics, forensic sciences, and evolutionary biology.

CO3: Evaluate the concepts of bio-business, intellectual property rights, patents, bioethics, biosafety, and regulatory frameworks governing biotechnology for responsible research, innovation, and commercialization.

CO4: Assess the scope and potential of emerging areas of biotechnology, including marine biotechnology, nanobiotechnology, pharmacogenomics, regenerative medicine, nutraceutical biotechnology, therapeutic proteins, biosensors, bio-robotics, and bioinformatics, in addressing contemporary societal and industrial challenges.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3063
Course Title: Fundamental of Biotechnology
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Emergence, scope and basics of Biotechnology

Historical perspective, Appraise the interplay of science and technology in the development of biotechnology, Definition, areas and overview of fundamentals of biotechnology, Role of Bacteria (*E. coli*), Yeast, Viruses (bacteriophages), *Drosophila melanogaster*, *Caenorhabditis elegans*, *Arabidopsis thaliana* as workhorses of biotechnology. Biotechnology research in India. biotechnology institutions in India (Public and private Sector), Biotech success stories, Biotech policy initiatives, careers and employment opportunities in biotechnology.

UNIT-II

Applications of Biotechnology: An Overview

Applying biotechnology to modern life styles: Healthcare – Biopharma : Recombinant human insulin, Recombinant hepatitis B vaccine; molecular diagnostics : PCR for infectious disease (viral / bacterial), blood screening and genetic testing, Gene therapy (for Alzheimer's disease), genetic counseling; Agriculture and food production (Genetically engineered food, seed banks, aquaculture); Green biotechnology (bioremediation, biofuels, conservation); Forensics and biodefense; Evo Devo (The development of life and human family tree).

UNIT-III

Bio business, Bioethics and IPRs in Biotechnology

Commercialization of biotechnology: concerns and consequences, biotechnology industry practices and Government regulations, concept and market potential of Bio business, IPR: introduction, types (trade secret, copyright, trademark), Requirements and Objectives of Patent, patentable and non-patentable inventions, process of writing and filing a patent, patenting genes/ gene fragments /SNPs/ proteins / stem cells. Patents related to bacteria, viruses, fungi and medicinal plants, plant breeder's right.

Ethical Issues and Regulating the use of Biotechnology: Human cloning, GM microorganisms, Food and Food ingredients, stem cells; Public Perception of Biotechnology: Consuming GM foods, GMOs and environment, antibiotic resistance; The future of Biotechnology.

UNIT-IV

Emerging fields of Biotechnology

An overview on marine biotechnology, nanobiotechnology, pharmacogenomics and drug discovery, nutraceutical biotechnology, regenerative medicine, therapeutic protein, biosensors and bio-robotics, role of computers and information technology in biotechnology

Books Recommended:

1. David P Clark & Nanette J. Pazdernik (2017) Biotechnology – Applying the Genetic Revolution, Elsevier Academic Press.
2. Bernard R Glick, Jack J Pasternak and Cheryl L Patten (2010) Molecular Biotechnology: Principles and applications of Recombinant DNA, ASM Press.
3. Singh, B.D. (2018). Biotechnology expanding horizons, Kalyani Publishers, New Delhi.
4. Singh, I. and Kaur, B (2010) Patent law and Entrepreneurship, 3rd Edition, Kalyani Publishers.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3063
Course Title: Fundamental of Biotechnology
(Practical)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Demonstrate Good Laboratory Practices (GLP), laboratory safety measures, and standard operating procedures in a biotechnology laboratory.

CO2: Operate and maintain basic biotechnology laboratory instruments by following standard operating procedures and laboratory protocols.

CO3: Apply appropriate procedures for the safe handling, decontamination, and disposal of hazardous chemicals and laboratory waste in accordance with biosafety guidelines.

CO4: Illustrate the process of patent drafting and filing through a biotechnology-related case study, highlighting the essential steps involved in securing intellectual property rights.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3063
Course Title: Fundamental of Biotechnology
(Practical)

Time: 3 hours

Practical marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Good laboratory practices followed in biotechnology laboratory
2. Introduction, use and maintenance of basic equipments in a biotechnology laboratory (Auto-pipettes, weighing balance, pH meter, water bath, dry bath, spectrophotometer, centrifuges, light microscope, electrophoretic apparatus, vortex mixer, magnetic stirrer, rocker, laminar hoods, autoclave, sonicator, UV transilluminator, hot air oven, BOD incubator)
3. Handling and disposal of hazardous reagents (acids, carcinogenic chemicals like acrylamide, ethidium bromide) and concept of chemical hoods.
4. Different steps for patent with the help of example.

Books recommended:

1. Pressman, D., and Blau, D. E. (2020). Patent it yourself: your step-by-step guide to filing at the US Patent office. Nolo.
2. Verma, A. S., Surajit, D., and Anchal, S. (2014). Laboratory manual for Biotechnology. S. Chand Publishing.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3084
Couse Title: Biochemistry-III
(Theory)

COURSE OUTCOMES:

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

CO1: Explain the biosynthesis, degradation, feeder pathways, and regulation of carbohydrate metabolism, including glycolysis and gluconeogenesis.

CO2: Analyze the amphibolic role, regulation, and bioenergetics of the Krebs cycle, glyoxylate pathway, electron transport chain, oxidative phosphorylation, and ATP synthesis.

CO3: Apply the principles of lipid metabolism to explain fatty acid oxidation and synthesis, metabolism of triacylglycerols and phosphoglycerides, and cholesterol biosynthesis.

CO4: Evaluate the de novo and salvage pathways of purine and pyrimidine biosynthesis and the regulation of nucleotide metabolism.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM 3084
Couse Title: Biochemistry-III
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Carbohydrate metabolism: Biosynthesis and degradation of carbohydrates, Glycolysis, gluconeogenesis, feeders pathways for glycolysis, regulation of carbohydrates metabolism.

UNIT-II

Kreb's cycle: Amphibolic nature of kreb's cycle, regulation and enzymes of kreb's cycle, glyoxylate pathway. Electron transport chain:- Mitochondrial electron chain, oxidative phosphorylation, chemiosmotic hypothesis, ATP synthase and regulation of ATP synthesis

UNIT-III

Lipid Metabolism: Oxidation and Synthesis of fatty acids, degradation of triacylglycerol and phosphoglycerides, Synthesis of Cholesterol

UNIT-IV

Nucleic Acid Metabolism: denovo and salvage pathways for purine and pyrimidines biosynthesis, regulation of nucleotide biosynthesis.

Books recommended:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry*. Macmillan.
2. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*.

Macmillan Higher Education.

3. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
4. J L Jain, Sunjay Jain, Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM 3084
Couse Title: Biochemistry-III
(Practical)

Upon successful completion of this course, the learners will be able to:

CO1: Perform quantitative estimation of amino acids using the ninhydrin reaction and interpret the experimental results.

CO2: Analyze and interpret the spectral characteristics of plant pigments using spectrophotometric techniques.

CO3: Demonstrate the extraction and separation of lipids from wheat grains and evaluate the efficiency of the procedure.

CO4: Perform the isolation of casein and determination of fat content in milk using standard biochemical techniques and interpret the findings.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM 3084
Couse Title: Biochemistry-III
(Practical)

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments

1. Quantitative estimation of amino acids using the ninhydrin reaction.
2. Spectral analysis of various plant pigments
3. Separation of lipids from wheat grains.
4. Isolation of Casein from milk
5. Determination of fat content in milk
6. Quantitative estimation of glucose by the DNS (3,5-dinitrosalicylic acid) method.

Books Recommended:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry*. Macmillan.
2. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*. Macmillan Higher Education.
3. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
4. J L Jain, Sunjay Jain, Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier.
6. Plummer D (2006) An introduction to Practical Biochemistry. Tata McGraw Hill Publishing Co., New Delhi.
7. Sawhney S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publication House, New Delhi.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTI 3065
Couse Title: Internship

Upon successful completion of this course, the learners will be able to:

CO1: Apply disciplinary knowledge, technical competencies, and standard professional practices to perform assigned tasks effectively in industrial, research, healthcare, or other professional settings.

CO2: Analyze workplace processes and real-world challenges to identify problems and recommend appropriate scientific or technical solutions.

CO3: Demonstrate professional ethics, effective communication, teamwork, leadership, and responsible workplace behavior while functioning in multidisciplinary professional environments.

CO4: Evaluate professional experiences and learning outcomes by preparing, presenting, and defending a comprehensive internship report that demonstrates reflective learning and professional competence.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTI 3065
Couse Title: Internship

Time: 3 Hours
L-T-P: 0-0-2

Max. Marks:50

Practical:50

Evaluation of report based on above themes will be evaluated by board of three internal examiners. Award list will be submitted thereafter.

It is a course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution. A key aspect of the internship/apprenticeship is induction into actual work situations. It involves working with local industry, government or private organizations, business organizations, artists, craft persons, and similar entities to provide opportunities for students to actively engage in onsite experiential learning.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3060
Couse Title: Skill Development in Biotechnology
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles, production processes, quality standards, and agricultural applications of biofertilizers, including the molecular basis of biological nitrogen fixation.

CO2: Analyze the therapeutic significance of medicinal plants, phytochemicals, and essential oils, together with their extraction methods and industrial applications.

CO3: Evaluate the scientific basis and health-promoting potential of nutraceuticals and functional foods, including nutritional genomics, quality control, and quality assurance practices.

CO4: Assess the applications of biofuels, bioenergy, bioremediation, and bioentrepreneurship in promoting sustainable development and biotechnology-driven innovation.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3060
Couse Title: Skill Development in Biotechnology
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Biofertilizers: Introduction and types and importance of biofertilizers, Microorganisms used in biofertilizers production, Biological Nitrogen fixation VIZ: Rhizobium: Process of nodule formation, Role of Nif and Nod gene in, Enzyme nitrogenase and its component, Different methods of application of biofertilizers, Strategies of Mass production and packing, Registration of biofertilizers.

UNIT-II

Herbal Biotechnology: Introduction to medicinal plants and their medicinal value, Phytochemicals, Essential oil: definition, extraction and applications in domestic life, industry and other purposes (Eucalyptus, Lavender, Rosa grass, Tulsi)

UNIT-III

Nutraceuticals and Functional Foods: Introduction to Nutraceuticals as Science, Properties, structure and functions of various Nutraceuticals, Food as remedies, Anti-nutritional Factors present in Foods, Nutraceuticals and Functional, Functional Foods, Nutritional Genomics, Quality Control, Quality Assurance

UNIT-IV

Biofuels, bioenergy, bioremediation and Bioentrepreneurship

Introduction to biofuels and green bioenergy sources, plant and microbe as alternating sources of bioenergy production, biofuels from waste products, bioremediation-types, biodegradation of herbicides, antibiotics, plastic menace and oil spills.

Overview of bioindustries, public/private funding opportunities; Innovation-focused thinking. Preparation of a business plan: socio-economic cost benefit analysis; Statutory and legal aspects. Business and market strategy: pricing, financing, market linkages, branding

Books Recommended:

1. Oladiji, A. T., Ajayi, E. I., Temidayo, A., Oladiji, O., & Olaley, J. (2024). *Nutrition and Diet in Health*.
2. Rakshit, A., Meena, V. S., Fraceto, L. F., Parihar, M., Benavides-Mendoza, A., & Singh, H. B. (Eds.). (2024). *Bio-inoculants in Horticultural Crops: Advances in Bio-inoculant, Volume 3*. Elsevier.
3. Singh, S., Datta, R., Johri, P., & Trivedi, M. (Eds.). (2022). *Phytopharmaceuticals and biotechnology of herbal plants*. CRC Press.
4. Kommu, S., Thirumurugan, R., Madupoju, B. (Eds.) (2024). *Text book of Nutraceuticals and Functional Foods: Theory and Applications*. Notion Press.
5. Gurunathan, B., Sahadevan, R., Zakaria, Z.A. (2021) *Biofuels and Bioenergy: Opportunities and Challenges*. Elsevier.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM-3060
Couse Title: Skill Development in Biotechnology
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Perform the isolation, cultivation, and production of *Rhizobium*-based biofertilizers using standard microbiological techniques.

CO2: Demonstrate the extraction of essential oils from plant materials using appropriate distillation techniques.

CO3: Analyze the phytochemical composition of essential oils by determining their total polyphenolic and flavonoid contents using standard analytical methods.

CO4: Evaluate the antioxidant and antimicrobial potential of essential oils using DPPH and antimicrobial assays, and interpret the experimental findings for their potential biotechnological applications.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Batch: 2026-30
Course Code: BBTM 3060
Couse Title: Skill Development in Biotechnology
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. Isolation of Rhizobium from root nodules
2. Production of commercial biofertilizers using Rhizobium.
3. Extraction of essential oils through oil distillation apparatus.
4. To measure total polyphenolic content of the essential oil.
5. Total flavonoid content of the essential oil.
6. Investigating the antioxidant potential of the oils by DPPH assay.
7. Antimicrobial activity of essential oils.

Books Recommended:

1. Oladiji, Adenike Temidayo, et al. *Nutrition and Diet in Health*. 2024.
2. Waste, F. P. (2025). *Emerging methods for oil extraction from food processing waste*. CRC Press: Boca Raton, FL, USA.
3. Nayik, G. A., & Ansari, M. J. (Eds.). (2023). *Essential oils: extraction, characterization and applications*. Academic Press.
4. Al-Harrasi, A., Al-Rawahi, A., Al Hatmi, S. A., & Bhatia, S. (2025). *Medicinal and Aromatic Plants of Oman: Phytochemistry and Ethno-Pharmacological Aspects, Volume I*. CRC Press.

Semester-IV

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4061
Couse Title: Molecular Biology
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the molecular organization of DNA, experimental evidence establishing DNA as the genetic material, and the structural organization of genomes and chromosomes in prokaryotes, eukaryotes, organelles, and viruses.

CO2: Analyze the mechanisms of DNA damage and the major DNA repair pathways involved in maintaining genome integrity and cellular stability.

CO3: Evaluate the molecular mechanisms of genetic information flow by interpreting the processes of genetic coding, protein synthesis, post-translational modifications, and translational regulation.

CO4: Assess the principles of genetic linkage, DNA recombination, and mutation, and appraise their significance in genome evolution, genetic diversity, and biotechnological applications.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4061
Couse Title: Molecular Biology
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

DNA as genetic material, structure of DNA, experimental evidence for DNA as genetic material (Griffith's transformation experiment, Avery and Macleod experiment and Hershey and Chase experiment), DNA to chromosome: genomes of bacteria, eukaryotes, organelles and viruses, Linear and Circular chromosomes, single stranded and doubles stranded DNA/RNA viral genome, organization DNA into chromosomes: Heterochromatin and euchromatin, brief idea of chloroplast DNA and mitochondrial DNA.

UNIT-II

DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: photoreactivation, bases excision repair, nucleotide excision repair, mismatch repair, SOS repair recombinational repair,

UNIT-III

Genetic code, Protein synthesis and processing: Ribosome, initiation factors aminoacylation of tRNA, aminoacyl tRNA synthetase, formation of initiation complex, elongation and elongation factors, termination and termination factors, and post translational modifications, inhibitors of translation.

UNIT-IV

DNA linkage, DNA recombination: general overview of types of DNA recombination- homologous, non-homologous, site specific and replicative recombination), linkage and recombination of gene in a chromosome crossing-over, cytological basis of crossing over, molecular mechanism of crossing

over, Holliday model of recombination. Mutation: Spontaneous versus induced mutations, types of mutations (missense mutation, non-sense mutation, silent mutation, point mutation, frameshift mutation), mutations rate and frequency, Mutagens: Physical and Chemical, the molecular basis of mutations. Significance and Practical applications of Mutation.

Books Recommended:

1. George M Malacinski (2015) Freifelders Essentials of Molecular Biology, 4Th/Ed, Jones & Bartlett
2. Clark, D. P., Pazdernik, N. J., McGehee, M. R., & Rader, B. A. (2025). *Biotechnology: The Technological Applications of Genetics and Genomics*. Elsevier.
3. Pk Gupta (2018) Molecular biology, 2nd Edition, Rastogi Publications
4. James D. Watson, A. Baker Tania, P. Bell Stephen, Gann Alexander, Levine Michael, Losick Richard (2017) Molecular Biology of the Gene, 7th Ed, Pearson Education

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4061
Couse Title: Molecular Biology
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Prepare laboratory reagents and stock solutions by following Good Laboratory Practices (GLP) and standard laboratory protocols.

CO2: Isolate genomic DNA from human samples and RNA from plant tissues using standard molecular biology techniques.

CO3: Estimate the concentration and purity of nucleic acids using fluorometric analysis and analyze the experimental data.

CO4: Perform agarose gel preparation and electrophoresis for the separation and visualization of nucleic acids.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4061
Couse Title: Molecular Biology
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. Preparation of stock solutions.
2. Isolation of human genomic DNA.
3. RNA isolation from plants.
4. Quantification of DNA by fluorometric (Ethidium bromide) analysis
5. Preparation of Agarose gel for agarose gel electrophoresis

Books Recommended:

1. S.B. Primrose and R.M. Twyman; Principles of Gene Manipulation. 2006.
2. J. Sambrook and Michael R. Green; Molecular Cloning: A Laboratory Manual, (Fourth Edition), CSHL, 2012.
3. Brown, T. A. (2023). *Genomes 5*. CRC Press.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4062
Couse Title: Biochemical and Biophysical Techniques
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles, instrumentation, and applications of centrifugation techniques, including sedimentation theory, centrifuge types, rotor selection, and factors influencing sedimentation.

CO2: Analyze the principles and applications of chromatographic techniques for the separation, purification, and characterization of biomolecules.

CO3: Evaluate the principles, instrumentation, and analytical applications of advanced chromatographic techniques.

CO4: Assess the principles, instrumentation, and applications of spectroscopic techniques for qualitative and quantitative biomolecular analysis.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30

Course Code: BBTM-4062
Couse Title: Biochemical and Biophysical Techniques
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Centrifugation: Basic principles of sedimentation, theory and applications of preparative and analytical centrifugation, Differential and density gradient centrifugation, Types of centrifugation machines and rotors, Sedimentation co-efficient, Factors affecting sedimentation coefficient, care of rotors.

UNIT-II

Chromatography: Partition Coefficient, Theory and Principle of Paper and column chromatography, Two-dimensional chromatography, gel exclusion chromatography, Principle and applications of paper, thin layer, ion-exchange, and affinity chromatography.

Section-C

Gas Liquid Chromatography, High Performance Liquid chromatography, Fast Protein Liquid chromatography

Section-D

Spectroscopy: Basic Principle, Lambert Beer's law, Absorption spectrum, theory and principles of single and double beam UV/Visible spectroscopy, Basic Principle and instrumentation of NMR and ESR.

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2022) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.

3. Freifelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman, and Co.
4. Plummer D (2006) An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co., New Delhi.
5. Wilson K and Walker J (2010) Principles and Techniques of Practical Biochemistry, Cambridge University Press, UK
6. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Publication House, New Delhi.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4062
Couse Title: Biochemical and Biophysical Techniques
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Demonstrate the operation of different centrifugation techniques, including swing-out rotor, angle rotor, and differential centrifugation, for the separation of biological samples.

CO2: Perform the separation of biomolecules using paper chromatography and thin-layer chromatography by following standard laboratory procedures.

CO3: Analyze the separation and purification of proteins using ion-exchange and affinity chromatography based on their physicochemical properties.

CO4: Interpret the experimental results obtained from centrifugation and chromatographic techniques for the qualitative analysis and purification of biomolecules.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4062
Couse Title: Biochemical and Biophysical Techniques
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. To study sedimentation using swing out rotor and angle rotor.
2. To study differential centrifugation
3. To study separation of bio-molecules by paper chromatography.
4. To study separation of bio-molecules by thin layer chromatography.
5. Separation of proteins by ion-exchange column chromatography
6. Separation of proteins by affinity column chromatography

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2022) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
3. Friefelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman and Co.
4. Plummer D (2006) An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co., New Delhi.
5. Wilson K and Walker J (2010) Principles and Techniques of Practical Biochemistry, Cambridge University Press, UK
6. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Pub. House, New Delhi.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4083
Couse Title: Biochemistry-IV
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the nomenclature, classification, characteristics, specificity, and role of cofactors, coenzymes, and prosthetic groups in enzyme function.

CO2: Analyze the mechanisms of enzyme action, including active site structure, enzyme–substrate interactions, and catalytic mechanisms.

CO3: Apply the principles of enzyme kinetics to determine kinetic parameters (K_m and V_{max}) using Michaelis–Menten, Lineweaver–Burk, and Hanes plots.

CO4: Evaluate the effects of enzyme inhibition, pH, temperature, reversible covalent modification, zymogen activation, and isozymes on enzyme activity and regulation.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4083
Couse Title: Biochemistry-IV
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100

Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Introduction to Enzymes: Nomenclature, Classification and Characteristics of enzymes, Enzyme specificity, Cofactors, Co-enzyme and Prosthetic group

UNIT-II

Mechanism of Enzyme Action: Nature of active site, identification of functional groups at active site, enzyme substrate complex, Factors responsible for catalytic efficiency of enzymes. Covalent catalysis, Acid base catalysis, Strain and distortion theory, Induced fit hypothesis.

UNIT-III

Enzyme Kinetics: A brief concept of bioenergetics and kinetics, Kinetics of single and bisubstrate enzyme catalyzed reactions, Michaelis Menten equation. Derivation of Michaelis Menten equation and determination of K_m and V_{max} values, Lineweaver-Burk plot, Hanes Plot

UNIT-IV

Enzyme inhibition: reversible and irreversible inhibition, Kinetics of competitive, uncompetitive and non-competitive inhibition. Effect of pH and temperature on rate of enzyme catalyzed reactions. Reversible covalent modification and zymogen activation, Isozymes and their importance

Books Recommended:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry*.

Macmillan.

2. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*. Macmillan Higher Education.
3. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
4. J L Jain, Sunjay Jain, Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4083
Couse Title: Biochemistry-IV
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Perform qualitative and quantitative assays of enzymes, including α -amylase and acid phosphatase, using standard biochemical techniques.

CO2: Analyze the effect of pH and temperature on enzyme activity and interpret the factors influencing enzyme catalysis.

CO3: Determine the kinetic parameter (K_m) of an enzyme and interpret enzyme kinetics using experimental data.

CO4: Apply biochemical methods for protein estimation using Lowry's method and evaluate the experimental results.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Batch: 2026-30
Course Code: BBTM-4083
Couse Title: Biochemistry-IV
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. Estimation of alpha-amylase activity from saliva.
2. Assay of acid phosphatase activity.
3. Effect of temperature on enzyme activity.
4. Effect of pH on enzyme activity
5. Determination of K_m for enzyme.
6. Protein estimation by Lowry's method

Books Recommended:

1. Nelson, D. L., Lehninger, A. L., & Cox, M. M. (2021). *Lehninger principles of biochemistry*. Macmillan.
2. Berg, J. M., Gatto Jr, G. J., Hines, J., Tymoczko, J. L., & Stryer, L. (2023). *Biochemistry*. Macmillan Higher Education.
3. Abali, E. E., Cline, S. D., Franklin, D. S., & Viselli, S. M. (2025). *Lippincott® illustrated reviews: biochemistry*. Lippincott Williams & Wilkins.
4. J L Jain, Sunjay Jain, Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier.
6. Plummer D (2006) An introduction to Practical Biochemistry. Tata McGraw Hill Publishing Co., New Delhi.
7. Sawhney S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publication House, New Delhi.

B.Sc. Bio-Technology Semester-V

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5061
Couse Title: r-DNA Technology-I
(Theory)

Upon successful completion of this course, the learners will be able to:

CO1: Explain the properties, mechanisms of action, and applications of DNA-modifying enzymes employed in recombinant DNA technology and molecular cloning.

CO2: Analyze the characteristics, selection strategies, and applications of cloning vectors used for gene cloning and recombinant DNA technology in *Escherichia coli*.

CO3: Evaluate the principles and applications of nucleic acid hybridization, blotting techniques, and gene transfer methods used in molecular biology and genetic engineering.

CO4: Assess the principles, methodologies, and detection strategies of radioactive and non-radioactive nucleic acid labelling for molecular diagnostics and biotechnology research.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V

Batch: 2026-30

Course Code: BBTM-5061

Couse Title: r-DNA Technology-I
(Theory)

Time: 3 Hours

L-T-P: 3-0-1

Max. Marks: 100

Practical:20

Theory: 50

CA:30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

DNA Modifying enzymes: Ligases for blunt and sticky end ligation, DNA Polymerases, Klenow fragment, Phosphatases, Polynucleotide kinase, Terminal deoxynucleotidyl transferase, Restriction enzymes, reverse transcriptase. RNase-H, DNase-I, Nuclease S-I

Unit-II

Cloning Vectors for *E. coli*: features of plasmids and development of plasmids as vector (α complementation), lytic and lysogenic cycle in Lambda: bacteriophages as vector, Genetic selection (Hfl, Spi) and histochemical selection, M13 as cloning vector, Cosmids

Unit-III

Southern and Northern blotting, Hybridization, Merits and demerits of nitrocellulose and nylon membranes (N and N+). Methods of Transformation: CaCl_2 , electroporation, transfection, microprojectile.

Unit-IV

Labelling of DNA and RNA- Radioactive labeling (Nick Translation, Random Priming, End Labelling), Non-Radioactive labelling (Direct and Indirect non isotopic labeling), Detection systems of labeled probes

Books Recommended:

1. Primrose, S. B., & Twyman, R. M. (2014). *Principles of gene manipulation and genomics*. Wiley-Blackwell
2. Watson, J. D., Myers, R. M., Caudy, A. A., & Witkowski, J. A. (2017). *Recombinant DNA: Genes and genomes—A short course*. W. H. Freeman.
3. Brown, T. A. (2025). *Gene cloning and DNA analysis: an introduction*. John Wiley & Sons.
4. Sharma, A. D. (2017). *rDNA technology* (2nd ed.). Himalaya Publishing House.
5. Reece, R. J. (2008). *Analysis of genes and genomes*. Wiley-Blackwell.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5061
Couse Title: r-DNA Technology-I
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Explain the principles underlying bacterial culture, genomic DNA isolation, restriction digestion, agarose gel electrophoresis, and Southern blotting.

CO2: Perform bacterial culture, genomic DNA isolation, spectrophotometric quantification, and agarose gel electrophoresis using standard molecular biology protocols.

CO3: Analyze DNA quality, restriction enzyme digestion patterns, and electrophoretic profiles to assess the integrity and characteristics of nucleic acid samples.

CO4: Evaluate the results of restriction digestion and Southern blotting for the detection and characterization of specific DNA sequences in molecular biology investigations.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5061
Couse Title: r-DNA Technology-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Isolation of genomic DNA from bacteria.
2. Spectrophotometric quantification of DNA and determination of purity.
3. Restriction enzyme digestion of the isolated DNA with 6, 5 and 4 cutters.
4. Southern Blotting.

Books Recommended:

1. S.B. Primrose and R.M. Twyman; Principles of Gene Manipulation. 2006.
2. J. Sambrook and Michael R. Green; Molecular Cloning: A Laboratory Manual, (Fourth Edition), CSHL, 2012.
3. Brown, T. A. (2023). *Genomes* 5. CRC Press.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5062
Couse Title: Animal Biotechnology-I
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles, laboratory design, aseptic techniques, cryopreservation methods, and characteristics of normal and transformed cells in animal tissue culture.

CO2: Analyze the sources, types, prevention, and control of contamination, laboratory biosafety practices, and cleanroom facilities required for safe and effective animal tissue culture.

CO3: Evaluate the composition, physicochemical properties, and applications of culture media and reagents, including serum-supplemented, serum-free, and conditioned media, for the cultivation of animal cells.

CO4: Assess the methodologies for primary and established cell culture, cell isolation, cultivation, growth kinetics, and cell proliferation analysis for applications in animal tissue culture research.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5062
Couse Title: Animal Biotechnology-I
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical:20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Historical background, Advantages and Disadvantages of animal tissue culture, Design and layout of ATC Lab, Equipments used in ATC Lab, Aseptic Techniques in ATC- Sterilization of culture media, glassware and tissue culture laboratory. Growth and viability of cells in culture, cryopreservation and retrieval of cells from frozen storage, transportation of cells. Characteristics of normal and transformed cells.

UNIT-II

Contamination- sources, Types, monitoring and eradication of contamination, Cross Contamination. Safety considerations in ATC laboratory, Clean Environment – P1, P2, P3 facility and their applications.

UNIT-III

Culture Media and Reagents-Types of cell culture media, physiochemical properties, balanced salt solution, constituents of serum, serum free media (SFM), design of SFM, Advantages and disadvantages of serum supplemented and serum free media, conditioned media

UNIT-IV

Primary culture and Established cell line Culture (Finite and continuous cell lines), Isolation of cells- Enzyme digestion, perfusion and mechanical disaggregation. Culture of attached cells and cells in suspension, phases of cell growth and determination of cell growth data (calculation of in vitro age, multiplication rate, population doubling time, cell counting, phases of cell cycle)

Books Recommended:

1. Freshney, R. I. and Davis A.C. (2021). *Culture of animal cells: A manual of basic technique and specialized applications* (8th ed.). John Wiley & Sons.
2. Davis, J. M. (Ed.). (2011). *Animal cell culture: Essential methods*. John Wiley & Sons.
3. Celis, J. E. (Ed.), Carter, N., Simons, K., Small, J. V., Hunter, T., & Shotton, D. (Eds.). (2006). *Cell biology: A laboratory handbook*. Elsevier Academic Press.
4. Butler, M. (2005). *Animal cell culture and technology*. Taylor & Francis.
5. Basic Cell Culture: A Practical Approach, 2nd ed. Edited by John Davis Oxford University Press, Oxford and New York. 2002 Davis, J. M. (2004). Basic cell culture: a practical approach. In *Basic cell culture: a practical approach*.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5062
Couse Title: Animal Biotechnology-I
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Explain the sources of contamination and the decontamination measures essential for maintaining aseptic conditions in an animal tissue culture laboratory.

CO2: Prepare balanced salt solutions, culture media, and serum by following standard protocols.

CO3: Perform the isolation and culture of lymphocytes from peripheral blood using aseptic techniques and appropriate cell culture procedures.

CO4: Analyze the quality of prepared media, serum, and cultured cells by interpreting laboratory observations and assessing their suitability for animal tissue culture applications.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5062
Couse Title: Animal Biotechnology-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Sources of contamination and decontamination measures.
2. Preparation of Hanks Balanced salt solution.
3. Preparation of Minimal Essential Growth medium.
4. Separation of Serum from blood.
5. Isolation and Culture of Lymphocytes from Peripheral Blood

Book Recommended:

1. Freshney, R. I. and Davis A.C. (2021). *Culture of animal cells: A manual of basic technique and specialized applications* (8th ed.). John Wiley & Sons.
2. Davis, J. M. (Ed.). (2011). *Animal cell culture: Essential methods*. John Wiley & Sons.
3. Celis, J. E. (Ed.), Carter, N., Simons, K., Small, J. V., Hunter, T., & Shotton, D. (Eds.). (2006). *Cell biology: A laboratory handbook*. Elsevier Academic Press.
4. Butler, M. (2005). *Animal cell culture and technology*. Taylor & Francis.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5063
Couse Title: Bioprocess Engineering-I
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

- CO1: Explain the fundamental principles of biochemical engineering, including heat and mass transfer, diffusion phenomena, oxygen transfer mechanisms, and microbial culture systems used in bioprocesses.
- CO2: Analyze microbial growth kinetics and evaluate the influence of kinetic parameters, substrate utilization, product formation, and biomass productivity on bioprocess performance.
- CO3: Evaluate the regulatory mechanisms governing microbial metabolism and product formation, including feedback regulation and the effects of environmental factors on bioprocess efficiency.
- CO4: Assess the principles, methods, and process design of sterilization systems employed in bioprocessing for ensuring aseptic operation and product quality.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5063
Couse Title: Bioprocess Engineering-I
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Introduction: Fundamental principles of Chemical Engineering and biochemical engineering. Fourier's Laws of heat transfer, Molecular diffusion, Diffusion theory, role of diffusion in bioprocessing, Oxygen transfer methodology in bioreactors and factors affecting oxygen transfer, Types of microbial culture: Batch, Fed batch and continuous culture.

Unit-II

Microbial Growth Kinetics: Simple kinetics of microbial growth, yield coefficient, doubling time, specific growth rate, substrate inhibition kinetics, product inhibition kinetics, metabolic and biomass productivities.

Unit-III

Internal and external feed back systems, effector molecules and its kinetics, Effect of temperature, pH and inducer on product synthesis.

Unit-IV

Sterilization: Introduction, air and media sterilizations, design of batch sterilization process, Del factor, sterilization cycle, continuous sterilization process, sterilization of fermenters.

Books Recommended:

1. Stanbury, P. F., Whitaker, A., & Hall, S. J. (2026). *Principles of fermentation technology* (3rd ed.). Elsevier Science.
2. Moo-Young, M. (2019). *Comprehensive biotechnology*. Elsevier.
3. Moo-Young, M., Anderson, W. A., & Chakrabarty, A. M. (Eds.). (2014). *Environmental biotechnology: principles and applications*. Springer Science & Business Media.
4. Bailey, J. E., & Ollis, D. F. (2018). *Biochemical engineering fundamentals*. McGraw-Hill.
5. Pirt, S. J. (1975). *Principles of microbe and cell cultivation* (pp. 274-pp).

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5063
Couse Title: Bioprocess Engineering-I
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Explain the principles of microbial growth, fermentation processes, and sterilization techniques employed in bioprocess engineering.

CO2: Perform microbial cultivation, determine growth kinetics, and evaluate specific growth rate and generation time using standard fermentation techniques.

CO3: Analyze the influence of process parameters, including temperature, pH, and aeration, on microbial growth and bioprocess performance.

CO4: Evaluate enzyme production and activity in bioreactor or shaking flask systems and interpret the experimental outcomes for process optimization.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5063
Couse Title: Bioprocess Engineering-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. To study the growth curve of microorganism.
2. To determine the specific growth rate and generation time of a bacterium during submerged fermentation.
3. Demonstration of sterilization of fermenter and other accessories.
4. To study the effect of temperature, pH and aeration on growth of microbes.
5. Production and assay of an enzyme in a Bioreactor/shaking flask.

Book Recommended:

1. Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory (Pearson Benjamin Cummings).
- Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Harlow, Addition-Wesley.
2. Plummer D.T. (2006). An introduction to practical biochemistry (Tata McGraw Hill Publishers Co. Ltd., New Delhi).
3. Bansal, D.D. (1985). Practical biochemistry (Standard Publication Chandigarh).

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTI-5065
Course Title: Internship

After passing this course the student will be able to:

CO1: Apply theoretical knowledge in real-life professional and community settings through experiential learning.

CO2: Develop practical skills, communication abilities, and professional ethics while working with industries and organizations.

CO3: Understand workplace culture, teamwork, and problem-solving approaches in different professional environments.

CO4: Prepare and present internship/community outreach reports effectively based on their field experiences.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTI-5065
Course Title: Internship

Time: 3 Hours
L-T-P: 0-0-2

Max. Marks:50

Evaluation of report based on above themes will be evaluated by board of three internal examiners. Students will be evaluated as satisfactory or unsatisfactory. Award list will be submitted

Course Outcomes:

1. It is a course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity.
2. A key aspect of the internship/ apprenticeship is induction into actual work situations.
3. It involves working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in onsite experiential learning

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30

Course Code: BBTS-5066

Course Title: Term Paper

Time: 3 Hours

Practical Marks: 25

L-T-P: 0-0-1

Instructions:

Term paper on recent advances in Life Sciences using Internet and Library based resources. To be presented as hard copy/ CD. Viva/ Seminar to be conducted by a panel of three internal examiners.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5060
Course Title: Food and Nutrition
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles of nutrition, food groups, nutrient requirements, energy balance, BMI, BMR, balanced diet, and nutritional disorders.

CO2: Apply the concepts of dietary nutrition to assess nutritional requirements and plan balanced diets for different age groups and physiological conditions.

CO3: Evaluate therapeutic diets for the dietary management of deficiency diseases and metabolic disorders.

CO4: Analyze the role of nutraceuticals, functional foods, food regulations, and Intellectual Property Rights (IPR) in ensuring food quality, safety, and public health.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V**

Batch: 2026-30

Course Code: BBTM-5060

**Course Title: Food and Nutrition
(Theory)**

Time: 3 Hours

L-T-P: 3-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Nutrition and Food Types-Definition, History and Scope of Nutrition. Functions of Food, Food types and groups, food guide–basic five food groups– Importance, uses. Food Introduction to nutrition–food as a source of nutrients, definition of nutrition, nutrients, adequate, optimum and good nutrition, malnutrition. Water Balance & Energy Balance. Energy value of Carbohydrates, Fats & Proteins. BMI & BMR of an individual. Balanced diet, Protein and carbohydrate malnutrition.

UNIT-II

Dietary Nutrition- Diet surveys and diet groups, recommended daily allowances and requirement of infants, children, adults, old people, Athletes, Expectant and nursing mothers. Food Exchange lists

UNIT-III

Therapeutic Nutrition-Importance of therapeutic nutrition, Deficiency diseases and disorders of metabolism. Planning of diets for patients suffering from Ulcer, Anaemia, Diarrhoea, Diabetes, Cardiac diseases, Jaundice, Nephritis and Tuberculosis.

UNIT-IV

Classification of Nutraceuticals and Functional Foods, Emulsions and emulsifiers, Malnutrition, Starvation and Obesity. Intellectual Property Rights (IPR) in food Industry. Govt. Regulatory Practices and Policies (FSSAI & FDI).

Books Recommended:

1. Campbell, T. C., & Campbell II, T. M. (2004). *The China Study* (book).
2. Pollan, M. (2009). *In defense of food: An eater's manifesto*. Penguin.
3. Pollan, M. (2013). *Food rules: An eater's manual*. Penguin.
4. Robinson, J. (2013). *Eating on the wild side: The missing link to optimum health*. Hachette UK.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5060
Course Title: Food and Nutrition
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Identify major nutrients in different food sources and apply food exchange lists for basic diet planning.

CO2: Calculate and interpret Body Mass Index (BMI) and Basal Metabolic Rate (BMR) to assess nutritional status.

CO3: Evaluate dietary intake and plan balanced diets for children, adults, and older adults according to nutritional requirements.

CO4: Design therapeutic diets for individuals with common clinical conditions such as ulcer, anemia, diabetes, diarrhea, and cardiac diseases.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-V
Batch: 2026-30
Course Code: BBTM-5060
Course Title: Food and Nutrition
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Identification of food sources for various nutrients.
2. Instruction to diet planning using food exchange list.
3. Calculation of BMI and BMR.
4. Evaluation of own diet.
5. Planning of diet for children, adult and old people.
6. Planning of diet for patient suffering from Ulcer, Anemia, Diabetes, Diarrhea and Cardiac diseases

Books Recommended:

1. Campbell, T. C., & Campbell II, T. M. (2004). *The China Study* (book).
2. Pollan, M. (2009). *In defense of food: An eater's manifesto*. Penguin.
3. Pollan, M. (2013). *Food rules: An eater's manual*. Penguin.
4. Robinson, J. (2013). *Eating on the wild side: The missing link to optimum health*. Hachette UK.

B.Sc. Bio-Technology Semester-VI

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6061
Course Title: rDNA Technology-II
(Theory)

COURSE OUTCOMES:

After successful completion of this course, the learners will be able to:

CO1: Describe the structure, characteristics, and applications of cloning and expression vectors used in recombinant DNA technology.

CO2: Explain the principles and methodologies of genomic cloning, cDNA cloning, PCR, microarray technology, and DNA sequencing.

CO3: Apply the concepts of recombinant DNA technology to the selection of appropriate cloning strategies, vectors, and molecular techniques for gene manipulation and analysis.

CO4: Analyze gene modification approaches for their applications in biotechnology and genetic engineering.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6061
Course Title: rDNA Technology-II
(Theory)

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

L-T-P: 3-0-1

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Phagemids, Fosmids, Cloning vectors for Eukaryotes (TAC, YAC, BAC, Ti plasmids), Expression Vectors pET280, pGEX, role of promoter, cassettes and gene fusion, important components of shuttle vectors.

UNIT-II

Overview of cloning, genomic cloning in (Lambda) vector, cDNA cloning: Linker, Adapters, Different strategies for cDNA cloning- self priming and adaptor linker methods.

UNIT-III

Principles and applications of PCR, Fundamental concepts and applications of microarray. DNA Sequencing: Sanger-Coulson method (chain terminating nucleotides), Maxam Gilbert method (chemical degradation of DNA),

UNIT-IV

Changing genes: site directed mutagenesis, cassette mutagenesis, single primer method, PCR methods of site directed mutagenesis, phage display: selection of mutant peptides

Books Recommended:

1. Primrose, S. B., & Twyman, R. M. (2014). *Principles of gene manipulation and genomics*. Wiley-Blackwell
2. Watson, J. D., Myers, R. M., Caudy, A. A., & Witkowski, J. A. (2017). *Recombinant DNA: Genes and genomes—A short course*. W. H. Freeman.
3. Brown, T. A. (2025). *Gene cloning and DNA analysis: an introduction*. John Wiley & Sons.
4. Sharma, A. D. (2017). *rDNA technology* (2nd ed.). Himalaya Publishing House.
5. Reece, R. J. (2008). *Analysis of genes and genomes*. Wiley-Blackwell.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6061
Course Title: r-DNA Technology-II
(Practical)

COURSE OUTCOMES:

After successful completion of this practical course, the learners will be able to:

CO1: Identify the principles and laboratory requirements for plasmid isolation, ligation, transformation, and PCR techniques.

CO2: Explain the principles underlying plasmid isolation, preparation of competent cells, transformation, and polymerase chain reaction (PCR).

CO3: Perform plasmid DNA isolation, ligation, competent cell preparation, bacterial transformation, and PCR using standard molecular biology protocols.

CO4: Analyze the outcomes of transformation and PCR experiments to verify successful gene transfer and amplification.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6061
Course Title: r-DNA Technology-II
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Isolation of plasmid DNA
2. To perform ligation reaction
3. Preparation of competent cells
4. Transformation of competent cells by CaCl_2 method.
5. Confirmation of the transformants for the presence of plasmid.
6. PCR

Books Recommended:

1. Primrose, S. B., & Twyman, R. M. (2014). *Principles of gene manipulation and genomics*. Wiley-Blackwell
2. Watson, J. D., Myers, R. M., Caudy, A. A., & Witkowski, J. A. (2017). *Recombinant DNA: Genes and genomes—A short course*. W. H. Freeman.
3. Brown, T. A. (2025). *Gene cloning and DNA analysis: an introduction*. John Wiley & Sons.
4. Sharma, A. D. (2017). *rDNA technology* (2nd ed.). Himalaya Publishing House.
5. Reece, R. J. (2008). *Analysis of genes and genomes*. Wiley-Blackwell.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6062
Course Title: Animal Biotechnology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Explain the characteristics of commonly used animal cell lines, cell differentiation, and organ culture techniques.

CO2: Analyze animal cell cloning vectors, transfection methods, promoters, expression vectors, and strategies for recombinant protein expression.

CO3: Apply the principles of animal cell culture for monoclonal antibody production, stem cell applications, large-scale cell cultivation, and bioreactor-based processes.

CO4: Evaluate the applications of genetic engineering in animal cells, including the production of therapeutic proteins, vaccines, transgenic animals, and animal cloning technologies.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme**

Semester-VI

Batch: 2026-30

Course Code: BBTM-6062

**Course Title: Animal Biotechnology-II
(Theory)**

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

L-T-P: 3-0-1

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit- I

Commonly used animal cell line, their origin and characteristics (WI-38, MRC-5, IMR-90, TIG 1, HEK-293, 3T3, BHK21-C13, C7, CHO-K1, A-2790, A9, B16, HeLa, A 549), Differentiation of cells, Organ Culture

Unit- II

Cloning Vectors (Fish Vector. P-element vector, SV 40 Vectors, Bovine Papilloma Virus Vector, Baculovirus Vector and Retroviral Vectors) Transfection methods (calcium phosphate precipitation, DEAE-Dextran-mediated transfection, Lipofection, electroporation, Retroviral infection, Microinjection), Promoters, Expression vectors and detection of transgenics, need to express proteins in animal cells.

Unit- III

Applications: Cell fusion and production of monoclonal antibodies; scale up methods for propagation of anchorage dependent and suspension cell culture; Bioreactors for large scale culture of cells; micro carrier cultures; Stem cells-characterization of embryonic stem cells and their applications

Unit-IV

Genetic Engineering in Animal Cells: Genetic engineering in production of Therapeutic proteins (Streptokinase), blood products (Blood Clotting Factor VIII); Latest Strategies to produce vaccines against Covid-19; and hormones (Erythropoietin); Transgenic animals (Mice, rabbit, Cattle, goat, sheep, pigs, Fish), Animal cloning- IVF, embryo transfer and Live Ovum Pickup (OPU)

Books Recommended:

1. Freshney, R. I. and Davis A.C. (2021). *Culture of animal cells: A manual of basic technique and specialized applications* (8th ed.). John Wiley & Sons.
2. Davis, J. M. (Ed.). (2011). *Animal cell culture: Essential methods*. John Wiley & Sons.
3. Celis, J. E. (Ed.), Carter, N., Simons, K., Small, J. V., Hunter, T., & Shotton, D. (Eds.). (2006). *Cell biology: A laboratory handbook*. Elsevier Academic Press.
4. Butler, M. (2005). *Animal cell culture and technology*. Taylor & Francis.
5. Basic Cell Culture: A Practical Approach, 2nd ed. Edited by John Davis Oxford University Press, Oxford and New York. 2002 Davis, J. M. (2004). Basic cell culture: a practical approach. In *Basic cell culture: a practical approach*.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI**

Batch: 2026-30

Course Code: BBTM-6062

Course Title: Animal Biotechnology-II

(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Demonstrate aseptic techniques for seeding, maintenance, observation, subculturing (trypsinization), and enumeration of animal cell cultures.

CO2: Perform isolation and quantification of genomic DNA and total RNA from blood samples using standard molecular biology techniques.

CO3: Evaluate cell viability and drug cytotoxicity by performing the MTT assay and determining the IC_{50} value of a test compound.

CO4: Perform separation and purification of IgG antibodies from serum using Protein A affinity chromatography and interpret the purification results.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6062
Course Title: Animal Biotechnology-II
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Seeding of cell line
2. Maintenance of a cell line and check doubling time
3. Observation of adherent (Fibroblastic, epithelial) and suspension cultures (Lymphoblast)
4. To perform trypsinization of cells
5. Cell counting by hemocytometer
6. DNA isolation from blood
7. Determination of the IC₅₀ value of a drug using MTT assay
8. Isolation of RNA from blood.
9. Separation and purification of IgG antibodies from Serum using protein A column.

Book Recommended:

1. Freshney, R. I. and Davis A.C. (2021). *Culture of animal cells: A manual of basic technique and specialized applications* (8th ed.). John Wiley & Sons.
2. Davis, J. M. (Ed.). (2011). *Animal cell culture: Essential methods*. John Wiley & Sons.
3. Celis, J. E. (Ed.), Carter, N., Simons, K., Small, J. V., Hunter, T., & Shotton, D. (Eds.). (2006). *Cell biology: A laboratory handbook*. Elsevier Academic Press.
4. Butler, M. (2005). *Animal cell culture and technology*. Taylor & Francis.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6063
Course Title: Bioprocess Engineering-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Explain the design, components, operation, and kinetics of fermenters and bioreactors used for microbial, plant, and animal cell cultures.
- CO2:** Apply the principles of process monitoring and control using pH, dissolved oxygen (DO), agitation, and other fermentation control systems.
- CO3:** Analyze downstream processing techniques, including cell separation, filtration, centrifugation, extraction, and product recovery in industrial fermentation.
- CO4:** Evaluate effluent treatment methods and fermentation economics for sustainable and efficient bioprocess industries.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6063
Course Title: Bioprocess Engineering-II
(Theory)

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

L-T-P: 3-0-1

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-1

Design of a Fermenter: Introduction, fermenter for microbial, animal and plant cell culture, Aseptic operation of fermenter, impeller and spargers, batch, fed batch, C.S.T.B.R, plug flow and air loop bioreactors and its kinetics

Unit-II

Control and measurement equipments of fermenter, pH and D.O. probes, Operation and agitation and its kinetics.

Unit-III

Down Stream Processing: Introduction, removal of microbial cells and other solid matters. Foam separation, filtration, industrial filters and its principles, centrifugation and industrial centrifuges, cell disruption, aqueous two-phase extraction system, super critical fluid extraction, whole broth processing.

Unit-IV

Effluent treatment, aerobic and anaerobic slug treatment process, fermentation economics.

Books Recommended:

- 1.Stanbury, P. F., Whitaker, A., & Hall, S. J. (2026). *Principles of fermentation technology* (3rd ed.). Elsevier Science.
- 2.Moo-Young, M. (2019). *Comprehensive biotechnology*. Elsevier.

3. Moo-Young, M., Anderson, W. A., & Chakrabarty, A. M. (Eds.). (2014). *Environmental biotechnology: principles and applications*. Springer Science & Business Media.
4. Bailey, J. E., & Ollis, D. F. (2018). *Biochemical engineering fundamentals*. McGraw-Hill.
5. Pirt, S. J. (1975). *Principles of microbe and cell cultivation* (pp. 274-pp).

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6063
Course Title: Bioprocess Engineering-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Demonstrate the construction, working, and operation of a Continuous Stirred Tank Bioreactor (CSTBR).
- CO2:** Perform qualitative and quantitative microbiological analysis of water using the Multiple Tube and Membrane Filter methods.
- CO3:** Determine the Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) of wastewater to assess water quality.
- CO4:** Interpret wastewater analysis results and evaluate treated effluents in accordance with Central Pollution Control Board (CPCB) standards.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6063
Course Title: Bioprocess Engineering-II
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. To study construction, working and operation of CSTBR.
2. Standard qualitative analysis of water- Multiple tube method
3. Quantitative analysis of water- Membrane Filter Method.
4. Determination of Biological Oxygen Demand (BOD) of waste water.
5. Determination of Chemical Oxygen Demand (COD) of waster water.
6. Central Pollution Control Board (CPCB) standards for discharge of treated waste water (effluents).

Book Recommended:

4. Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory (Pearson Benjamin Cummings).
- Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Harlow, Addition-Wesley.
5. Plummer D.T. (2006). An introduction to practical biochemistry (Tata McGraw Hill Publishers Co. Ltd., New Delhi).
6. Bansal, D.D. (1985). Practical biochemistry (Standard Publication Chandigarh).

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6064
Couse Title: Fundamental of Bioinformatics
(Theory)

COURSE OUTCOME:

After successful completion of this course, the learners will be able to:

CO1: Explain the fundamental concepts of computers, computer organization, hardware, software, storage devices, and input/output devices and their relevance in bioinformatics.

CO2: Apply the principles of bioinformatics, including pairwise sequence alignment algorithms, scoring matrices (PAM and BLOSUM), and multiple sequence alignment methods for biological sequence analysis.

CO3: Analyze biological sequence data using BLAST and interpret sequence alignment results for comparative analysis of nucleotide and protein sequences.

CO4: Utilize major biological databases and bioinformatics resources, for retrieval, annotation, and interpretation of biological information.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6064
Couse Title: Fundamental of Bioinformatics
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Computers: General introduction to computers, organization of computers, Computer hardware and software. Data Storage Devices: Primary and secondary Storage devices. Input/Output Device: Key tape/diskette devices, light pen mouse and joystick. Printed Output: Serial, line, page, printers; plotters, visual output; voice response units

Unit-II

Introduction to bioinformatics: History, Milestones and Applications, Local and Global alignments, Gap Penalties, Pairwise sequence alignments (Needleman-Wunsch, Smith- Watermann Algorithms), Significance of Sequence Alignment.

Unit-III

Scoring Matrices: PAM, BLOSUM

Multiple Sequence Alignment: Progressive Alignment, Iterative Alignment Methods

Database Searching: BLAST and its types

Unit-IV

Primary and Secondary databases, Online resources of Bioinformatics: Introduction about: NCBI, EBI, DDBJ, Expasy, PUBMED, PDB, UNIPROT, Pfam, Prosite.

Books Recommended:

1. Norton, P. (2002). *Introduction to Computing Fundamentals*. McGraw-Hill Education, New Delhi.
2. Pradeep, K., & Priti, S. (2004). *Computer Fundamentals*. BPB Publications.
3. Xiong, J. (2006). *Essential bioinformatics*. Cambridge University Press.
4. Baxevanis A.D. and Ouellette B.F.F. (2011). *Bioinformatics a Practical Guide to the Analysis of Genes and Proteins*. (3rd Edition) Wiley-Interscience

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6064
Couse Title: Fundamental of Bioinformatics
(Practical)

COURSE OUTCOME:

After successful completion of this course, the learners will be able to:

CO1: Explain the applications of MS Office tools, biological databases, and standard biological sequence formats used in bioinformatics.

CO2: Retrieve biological information from online databases, including NCBI, EMBL, UniProt, and PubMed, using appropriate search strategies.

CO3: Perform biological sequence analysis using BLAST, Clustal Omega, and standard sequence formats (FASTA and GenBank).

CO4: Analyze protein sequences to identify conserved domains and functional motifs using PFAM and PROSITE.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VI
Batch: 2026-30
Course Code: BBTM-6064
Couse Title: Fundamental of Bioinformatics
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. MS-Office: word, Excel, Power-point
2. Introduction about Various Databases: NCBI, EMBL, UNIPROT, PUBMED
3. GenBank Format, FASTA format etc.
4. Basic Local Alignment Search tools (BLAST)
5. Multiple Sequence Alignment using Clustal Omega
6. Prediction of Protein functional domain using PFAM/PROSITE

Books Recommended:

1. Norton, P. (2002). *Introduction to Computing Fundamentals*. McGraw-Hill Education, New Delhi.
2. Pradeep, K., & Priti, S. (2004). *Computer Fundamentals*. BPB Publications.
3. Xiong, J. (2006). *Essential bioinformatics*. Cambridge University Press.
4. Baxevanis A.D. and Ouellette B.F.F. (2011). *Bioinformatics a Practical Guide to the Analysis of Genes and Proteins*. (3rd Edition) Wiley-Interscience

B.Sc. Bio-Technology Semester-VII

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTL-7111
Course Title: AI in Biotechnology
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the fundamental concepts of artificial intelligence, machine learning, deep learning, computer vision and chatbot-based dialogue systems.

CO2: Apply AI-based approaches in healthcare for drug discovery, predictive analytics, clinical decision support and remote patient monitoring.

CO3: Analyze the role of AI in agricultural biotechnology, including crop monitoring, disease detection, precision farming and AI-assisted crop breeding.

CO4: Evaluate AI applications in soil and water management and microbial diagnosis, considering ethical, socio-economic and future technological challenges.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme**

Semester-VII

Batch: 2026-30

Course Code: BBTL-7111

Course Title: AI in Biotechnology

Time: 3 Hours

L-T-P: 4-0-0

Max. Marks: 100

Theory: 70

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 14 marks.

Unit-I

Fundamentals of AI: Introduction of AI, definition & history of AI, Types of AI, Machine learning: Definition & types, introduction of deep learning computer vision, chat bots & dialogue system

Unit-II

AI in Health Sciences: AI in Drug Discovery and Personalized Medicine; AI for Predictive Analytics in Healthcare; Clinical Decision Support Systems (CDSS); Ethics and Privacy in AI for Health; AI in Remote Patient Monitoring and Wearables; Challenges and Future Directions in AI for Healthcare.

Unit-III

AI in Agricultural Biotechnology: Introduction to AI in Agriculture, applications of AI in modernizing agricultural practices. AI-based crop monitoring and disease detection. Precision farming using AI-driven data analysis. AI based applications in crop breeding. Case Studies and Future Prospects: Real-world applications of AI in agriculture, Success stories of AI-driven agricultural advancements, Ethical and socio-economic considerations of AI adoption in farming

Unit-IV

AI in Soil and Water Management: AI-based soil health analysis and fertility prediction. Smart irrigation systems and water conservation techniques. AI-driven weather prediction and climate adaptation strategies.

Applications of AI in Microbial Diagnosis: Whole- Slide Imaging and Microbial Cytopathology, Detection of Infectious Diseases, AI-Enhanced Microscopes, Colony counting, antimicrobial Susceptibility Testing; Challenges and future perspectives.

Books Recommended:

1. Warwick, K. (2013). *Artificial intelligence: the basics*. Routledge.
2. Johannessen, J. A. (2024). *Artificial intelligence and the future of healthcare*. Routledge.

3. Agarwal, P., Khanna, K., Elngar, A. A., Obaid, A. J., & Polkowski, Z. (Eds.). (2023). *Artificial Intelligence for Smart Healthcare*. Springer.
4. Pandey, K., Kushwaha, N. L., Pande, C. B., & Singh, K. G. (2024). *Artificial Intelligence and Smart Agriculture*. Springer Nature Singapore.
5. Srivastava, A., & Mishra, V. (2025). *Artificial Intelligence in Microbiology: Scope and Challenges volume-II* (Vol. 56). Elsevier.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7062
Course Title: Bio-entrepreneurship
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the concepts of entrepreneurship, bioindustries, innovation-driven business development and the scope of bioentrepreneurship in India and globally.

CO2: Apply business planning principles to identify biotechnology business opportunities, develop sustainable business models and explore funding and incubation support mechanisms.

CO3: Analyze intellectual property rights, patent procedures, regulatory frameworks, biosafety guidelines and ethical issues associated with biotechnology enterprises.

CO4: Evaluate marketing strategies, technology transfer processes, academia–industry linkages and commercialization approaches through bioentrepreneurship case studies.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30

Course Code: BBTM-7062

Course Title: Bio-Entrepreneurship

Time: 3 Hours

L-T-P: 4-0-0

Max. Marks: 100

Theory: 70

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 14 marks.

Unit-I

Fundamentals of Bioentrepreneurship: Introduction to Entrepreneurship: Concept, characteristics, and types of entrepreneurs, Difference between entrepreneur, manager, and intrapreneur. Overview of bioindustries, Innovation-focused thinking. Scope of Bio entrepreneurship- Global and Indian perspectives of bio-business. Concept of Bio E3 in India.

Unit-II

Business Planning and Management: Business Opportunity, Risk and Sustainability Identification, Sources of bio-business ideas, Business Models in Biotechnology, Start-ups, incubators, Licensing, collaborations, and joint ventures. Funding in Bio-entrepreneurship public/private funding opportunities, Government schemes, CSR

Unit-III

Regulatory and Ethical Aspects: Introduction about IPR in Biotechnology, Patents, copyrights, trademarks, and trade secrets in biotech, Patent filing procedure (national & international) Regulatory Framework includes biosafety guidelines, clinical trials, quality certifications (GMP, GLP, ISO) and national and international regulatory bodies. Ethical issues in biotechnology (cloning, GMOs, stem cells, gene editing).

Unit-IV

Applied Bio-entrepreneurship and Case Studies: Marketing Strategies in Biotechnology, Branding, positioning, and product differentiation in biotech sector. Technology Transfer and Commercialization: Academia–Industry linkage, Incubation centres and technology parks.

Books Recommended

1. *Handbook of Bio-entrepreneurship*, Holger Patzelt and Thomas Brenner, eds., New York: Springer, 2008.
2. *Bio-entrepreneurship Development: A Resource Book*, Shreya Sanghvi Malik and Shiv Kant Shukla, Biotech Consortium India Limited (BCIL), New Delhi
3. *Fundamentals of Bio-entrepreneurship: Innovation In Biobusiness* by Dr. Singh Machiavelli, Pardeep Kumar, Shiv Swaroop Jha, M/s AGROBIOS (INDIA).

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7063
Course Title: Advanced Analytical Techniques
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles of mass spectrometry, fluorescence spectroscopy and Raman spectroscopy, including ionization methods and analyzers used for biomolecular analysis.

CO2: Apply electrophoretic techniques such as native PAGE, SDS-PAGE and agarose gel electrophoresis for the separation of biomolecules based on charge and molecular weight.

CO3: Analyze advanced separation methods including isoelectric focusing, two-dimensional gel electrophoresis and capillary electrophoresis for biomolecular characterization.

CO4: Evaluate radioisotopic techniques, scintillation counting methods and radiation safety practices for qualitative and quantitative biological investigations.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7063
Course Title: Advanced Analytical Techniques
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Mass spectroscopy: Ionization methods and Analyzers, MALDI TOF and MALDI Q, Applications of mass spectroscopy in biology for qualitative and quantitative determination of bio-molecules, Introduction to fluorescence spectroscopy, Raman Spectroscopy

Unit-II

Electrophoresis: Factors affecting electrophoretic mobility, Types of electrophoresis, Basic principle, theory and application of native, SDS-PAGE and Agarose Gel electrophoresis, Use of solubilizers in electrophoresis.

Unit-III

Introduction to IEF (Iso-electric focusing), Two-dimensional gel electrophoresis and capillary electrophoresis, Applications of electrophoresis in biology for isolation of biomolecules based on charge and molecular weight.

Unit-IV

Radioisotopic Techniques: Basic concepts of radioisotopy, theory and applications of Geiger-Muller tube, solid and liquid scintillation counters, primary and secondary flours. Safety rules for radioisotopic studies.

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2022) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.

2. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
3. Freifelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman, and Co.
4. Plummer D (2006) An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co., New Delhi.
5. Wilson K and Walker J (2010) Principles and Techniques of Practical Biochemistry, Cambridge University Press, UK
6. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Publication House, New Delhi.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7063
Course Title: Advanced Analytical Techniques
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Apply qualitative and quantitative methods for the analysis of DNA samples and interpret the results obtained.

CO2: Prepare and analyze standard curves for proteins and DNA for estimation of biomolecular concentrations.

CO3: Analyze the principles and procedures involved in casting vertical and horizontal gels for electrophoretic separation.

CO4: Evaluate the separation patterns of biomolecules obtained through vertical and horizontal gel electrophoresis and interpret their analytical significance.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30

Course Code: BBTM-7063
Course Title: Advanced Analytical Techniques
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Qualitative and quantitative analysis of DNA sample
2. Preparation of standard curve of protein
3. Preparation of standard curve of DNA.
4. Casting of vertical and horizontal gels for electrophoresis.
5. Separation of bio-molecules by vertical and horizontal gel electrophoresis

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2022) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
3. Freifelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman, and Co.
4. Plummer D (2006) An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co., New Delhi.
5. Wilson K and Walker J (2010) Principles and Techniques of Practical Biochemistry, Cambridge University Press, UK
6. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Publication House, New Delhi.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7064
Course Title: Plant Biotechnology-I
(Theory)**

COURSE OUTCOMES:

After successful completion of this course, the learners will be able to:

CO1: Describe the fundamental concepts of plant tissue culture, cellular totipotency, tissue competency, laboratory organization, and sterilization techniques.

CO2: Explain the composition of culture media and the roles of plant growth regulators in the growth and development of plant tissues under in vitro conditions.

CO3: Apply the principles of organogenesis, somatic embryogenesis, micropropagation, and acclimatization for in vitro plant regeneration and multiplication.

CO4: Analyze the applications of haploid and triploid production, embryo, ovule and ovary culture, and somaclonal variation in plant improvement and crop biotechnology.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7064
Course Title: Plant Biotechnology-I
(Theory)

Time: 3 Hours

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

L-T-P: 3-0-1

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Cellular totipotency; differentiation, dedifferentiation and redifferentiation of cells; tissue competency; plant-explant-plant concept.

Plant tissue culture lab: Layout and organization, infrastructure, equipments and instruments.

Sterilization methods for lab, glassware, tools, culture media and plant materials.

Unit-II

Culture Media: Nutritional requirements for plant tissue culture; types of media and role of different components; preparation of culture media.

Physiological functions and biosynthesis of major plant growth regulators such as auxins, cytokinins, gibberellins and abscisic acid.

Unit-III

Modes of regeneration: Organogenesis and somatic embryogenesis; types and applications of somatic embryogenesis. Micropropagation methods (axillary bud, shoot-tip and meristem culture); stages of micropropagation, factors affecting micropropagation and technical problems; acclimatization of tissue culture raised plants; applications of micropropagation; a brief account of synthetic seeds.

Unit IV

Haploid and triploid plant production through tissue culture and their applications; ovary and ovule culture; embryo culture and rescuing hybrid embryos; somaclonal variations, selection of variant cell lines and its applications.

Books Recommended:

1. Bhojwani, S. S., & Dantu, P. K. (2013). *Plant tissue culture: an introductory text* (Vol. 318). India: Springer.

2. Razdan, M. K. (2019). *Introduction to Plant Tissue Culture* (3rd ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
3. Davey, M. R., & Anthony, P. (2010). *Plant cell culture: essential methods*. John Wiley & Sons.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7064
Course Title: Plant Biotechnology-I
(Practical)

COURSE OUTCOMES:

After successful completion of this practical course, the learners will be able to:

CO1: Identify the laboratory infrastructure, essential instruments, culture vessels, and sterilization methods used in plant tissue culture.

CO2: Explain the principles of laboratory organization, aseptic techniques, culture media preparation, and sterilization procedures employed in plant tissue culture.

CO3: Perform the preparation of stock solutions, Murashige and Skoog (MS) medium, sterilization of culture materials, and aseptic inoculation of explants for in vitro culture establishment.

CO4: Analyze the suitability of explants, culture media, and sterilization procedures for the successful establishment of contamination-free plant tissue cultures.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7064
Course Title: Plant Biotechnology-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. To study functions and operations of various instruments required for plant tissue culture (pH meter, autoclave, laminar air-flow, incubators, oven, distillation unit etc.).
2. Laboratory design set up for a PTC Laboratory.
3. Cleaning of glassware, plasticware and contaminated cultures.
4. Different types of enclosure used in plant tissue culture. Preparation of cotton plugs.
5. Preparation of stock solutions of Murashige and Skoog (1962) medium.
6. Preparation of Murashige and Skoog's medium from stock solutions.
7. Different sterilization process (Instruments, glassware and thermolabile and thermostable components)
8. Selection, preparation, sterilization and inoculation of explants.

Books recommended:

1. Bhojwani, S. S., & Dantu, P. K. (2013). *Plant tissue culture: an introductory text* (Vol. 318). India: Springer.
2. Razdan, M. K. (2019). *Introduction to Plant Tissue Culture* (3rd ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
3. Davey, M. R., & Anthony, P. (2010). *Plant cell culture: essential methods*. John Wiley & Sons.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM -7065
Couse Title: Immunology-I
(Theory)

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the fundamental concepts of innate and adaptive immunity, including immunological memory, specificity, self–non-self recognition, and the terminology associated with the immune system.

CO2: Interpret the organization and functions of lymphoid cells, lymphoid organs, and the lymphatic system, and explain their coordinated roles in the generation and regulation of immune responses.

CO3: Analyze the structural and functional characteristics of antigens, immunoglobulins, and the complement system, and examine their roles in humoral immune responses.

CO4: Evaluate the role of Major Histocompatibility Complex (MHC) molecules and antigen receptors of T and B lymphocytes in antigen recognition, antigen presentation, and adaptive immune responses.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM -7065
Couse Title: Immunology-I
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setter: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

UNIT-I

Types of immunity-innate and adaptive; Features of immune response-memory; Specificity and recognition of self and non-self; Terminology used in the study of immune system.

UNIT-II

Lymphoid cells, heterogeneity of lymphoid cells; T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic.

UNIT-III

Antigen, Epitope (B cell and T Cell epitope), Immunogen, Factors influencing immunogenicity, Immunoglobulins, classes and structure; affinity and avidity; Complement fixing antibodies and complement cascade.

UNIT-IV

MHC class I and class II molecules, structure T and B Cells and function of class I and class II MHC molecules, structure of T-cell antigen receptors.

Books Recommended:

- 1.Murphy, K., & Weaver, C. (2017). *Janeway's immunobiology*. 9th edition. Garland science.
- 2.Owen, J., Stranford S.A., Jones P.P., Owen J.A. (2018). *Kuby immunology*. New York: W.H. Freeman, Macmillan Learning.
- 3.Abbas, A. K., Lichtman, A. H., Pillai, S., Henrickson S. (2025). *Cellular and molecular immunology* (11th ed.). Elsevier.
- 4.Flajnik, M. (2022). *Paul's fundamental immunology*. Lippincott Williams & Wilkins.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM -7065
Couse Title: Immunology-I
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Perform safe blood collection, plasma separation, and hematological investigations using standard laboratory procedures and aseptic techniques.

CO2: Determine total and differential blood cell counts and interpret hematological parameters for the assessment of immune and physiological status.

CO3: Isolate peripheral blood mononuclear cells (PBMCs) and evaluate cell viability using standard dye exclusion techniques.

CO4: Demonstrate antigen–antibody interactions by performing different immunological techniques and analyze the experimental outcomes.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM -7065
Couse Title: Immunology-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. Collection of blood sample by different method.
2. Separation of Plasma from blood
3. Differential leucocytes count
4. Total Leucocytes count
5. Total RBC count
6. Isolation of mononuclear cells from peripheral blood and to check their viability by dye exclusion method.
7. Ouchterlony Double Immunodiffusion Test.
8. Haemagglutination assay.
9. Haemagglutination Inhibition assay.

Books Recommended:

1. Miller, L. E., & Stevens, C. D. (2023). Clinical immunology and serology.
2. Celis, J.E. (2021). Cell Biology: A laboratory handbook Amsterdam ; Boston : Elsevier Academic
3. Hay, F.C. Westwood O.M.R. (2002). Practical Immunology, 4th Ed., Blackwell Science, U.K.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTI-7066
Course Title: Internship

After passing this course the student will be able to:

CO1: Apply theoretical knowledge in real-life professional and community settings through experiential learning.

CO2: Develop practical skills, communication abilities, and professional ethics while working with industries and organizations.

CO3: Understand workplace culture, teamwork, and problem-solving approaches in different professional environments.

CO4: Prepare and present internship/community outreach reports effectively based on their field experiences.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTI-7066
Course Title: Internship

Time: 3 Hours
L-T-P: 0-0-2

Max. Marks:50

Evaluation of report based on above themes will be evaluated by board of three internal examiners. Students will be evaluated as satisfactory or unsatisfactory. Award list will be submitted

Course Outcomes:

1. It is a course requiring students to participate in a professional activity or work experience, or cooperative education activity with an entity external to the education institution, normally under the supervision of an expert of the given external entity.
2. A key aspect of the internship/ apprenticeship is induction into actual work situations.
3. It involves working with local industry, government or private organizations, business organizations, artists, crafts persons, and similar entities to provide opportunities for students to actively engage in onsite experiential learning

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7060
Course Title: Industrial Biotechnology-I
(Theory)

COURSE OUTCOMES:

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

CO1: Explain the concepts of industrial fermentation, food processing, agri-based industries, and the significance of biotechnology in industrial production and entrepreneurship.

CO2: Apply techniques for the isolation, screening, characterization, preservation, strain improvement, inoculum development, media formulation, and process optimization of industrially important microorganisms.

CO3: Analyze the production processes of industrially important metabolites, antibiotics, fermented foods, dairy products, and industrial enzymes with respect to their applications and production strategies.

CO4: Design sustainable and innovative bioprocesses by integrating emerging technologies such as precision fermentation, synthetic biology, metabolic engineering, AI-assisted bioprocess optimization, bioplastics, biorefinery, and single-cell protein production for industrial and entrepreneurial applications.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30**

**Course Code: BBTM-7060
Course Title: Industrial Biotechnology-I
(Theory)**

**Time: 3 Hours
L-T-P: 3-0-1**

**Max. Marks: 100
Theory: 50
Practical: 20
CA: 30**

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Basic concept of industrial fermentation and its significance in industry, Introduction: Basic concept of agriculture and food processing as industry, methods and principles of food processing, differences between microbial industrial processes and chemical industrial processes. Scope for entrepreneurship in food processing, agri-based industries, and biotechnology sectors.

Unit-II

General study and characterization of Industrially important microbes. Methods of isolation, screening (primary and secondary methods), selection and identification, maintenance, and preservation of industrially important microbial cultures.

Unit-III

Strain improvement of industrial important microbes: by using mutational programme and recombination systems (parasexual cycle, protoplast fusion and recombinant DNA techniques), isolation of mutants (induced, auxotrophic, resistant and revertant mutants), inoculums development, media formulation and process optimization of industrial and agro industrial microbes.

Unit-IV

Introduction to primary and secondary metabolites production. Production of Tetracycline and penicillin, Dairy products like curd, yoghurt, cheese, bread. Fermented foods-Pickles, Sauerkraut, Enzyme Production-Amylases, cellulases, proteases in leather industries. Emerging bioproducts and sustainable bioprocesses, including microprotein (single-cell protein) production, bioplastics, biorefinery, precision fermentation, synthetic biology, metabolic engineering, and AI-assisted bioprocess optimization.

Books Recommended:

1. Wittmann, C. and Liao, J. (2017). Industrial Biotechnology: Products and Processes (Advanced Biotechnology), Vol. 4 Wiley-VCH.
2. Singh B.D. (2016). Biotechnology: Expanding horizons, Kalyani Publishers / Lyall Bk Depot
3. Chakraborty, P.K. (2013). Agro and Industrial Biotechnology, Black Prints
4. Tyagi, N. (2012). Industrial Microbiology and Biotechnology, Agrotech Press.
5. Casida, L.E.J.R. (2007). Industrial Microbiology, New Age International Publishers
6. Okafor N, Okeke B.C. (2018). Modern Industrial Microbiology and Biotechnology, 2nd edition, CRC Press.
7. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
8. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5th Edition, The Benjamin / Cummings Publishing Company, Inc.
9. Stanier, R.Y. (1995). General microbiology, MacMillan Press, London.
10. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
11. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
12. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBS Publishers & Distributors.
13. Purohit, S.S. (2000). Microbiology: Fundamentals and Applications (6th Edition), Agrobios (India).
14. Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
15. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.
16. Stanbury, P.F., Whitaker, A. and Hall, S.J. (2001), Principles of Fermentation Technology 2nd ed., Pergamon Press, Oxford.
17. Frazier, W.C. and Westhoff, D.C. (2003) Food Microbiology. 18th Edition, Tata McGraw Hill, Inc., New York.
18. Industrial Biotechnology: Approach to Clean Technology · Jogdand, S.N. Himalaya Publishing House 2006. ISBN: ISBN number: 9788183184250

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7060
Course Title: Industrial Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Apply aseptic techniques for the isolation, cultivation, characterization, and preservation of industrially important microorganisms.

CO2: Analyze microbial physiological and biochemical characteristics using microscopy, IMViC tests, nitrate reduction, and fermentation assays.

CO3: Evaluate starter cultures, fermentation processes, and microbial enzyme production for their industrial and food biotechnology applications.

CO4: Design and optimize basic fermentation experiments, including media preparation, inoculum development, and screening of industrially important microorganisms for biotechnological applications.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VII
Batch: 2026-30
Course Code: BBTM-7060
Course Title: Industrial Biotechnology-I
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments

1. Isolation of microbial cells by serial dilution-spread plate method.
2. Measurement of bacterial size.
3. Metabolic Characterization by IMVIC test
4. Alcoholic and Mixed–Acid Fermentation.
5. Starter culture preparation, evaluation and application.
6. Determination of nitrate reduction by bacteria.

Books Recommended:

1. Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory (Pearson Benjamin Cummings).
2. Plummer D.T. (2004). An introduction to practical biochemistry (Tata McGraw Hill Publishers Co. Ltd., New Delhi).
3. Bansal, D.D., K Hardori, R., Gupta, M.M. (1985). Practical biochemistry (Standard Publication Chandigarh).
4. Dubey R.C. and Maheshwari (2012) Practical Microbiology 5th edition: S. Chand and company ltd. New Delhi.

B.Sc. Bio-Technology Semester-VIII

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8060
Course Title: Ecology and Evolution
(Theory)

COURSE OUTCOME:

After successful completion of this course, the learners will be able to:

CO1: Explain the fundamental concepts of ecology, environmental components, habitat, niche, trophic interactions, nutrient cycling, and species interactions.

CO2: Analyze ecological succession, ecosystem structure and function, energy flow, biogeochemical cycles, and biodiversity conservation strategies for sustainable ecosystem management.

CO3: Interpret the principles of organic evolution, origin of life, natural selection, and speciation using classical and modern evolutionary theories.

CO4: Apply the principles of population genetics, molecular evolution, phylogenetic reconstruction, and biogeography to explain genetic variation, evolutionary relationships, and species diversification.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8060
Course Title: Ecology and Evolution
(Theory)

Time: 3 Hours

Max. Marks: 100

L-T-P: 3-0-1

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

The Environment: Physical environment; biotic environment; biotic and abiotic interactions: trophic levels and their interactions; nutrient cycles; primary and secondary levels. Habitat and Niche: Concept of habitat and niche; niche width and overlap; fundamental and realized Species. Interactions: Types of interactions (mutualism, symbiosis, commensalism, competition, parasitism, predation, etc.), interspecific competition (physiological adaptations to abiotic environment); prey- predator interactions (Lotka-Volterra equation etc.), prey predator interactions (mimicry, crypsis, etc.).

Unit-II

Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax. **Ecosystem Ecology:** Ecosystem structure; ecosystem function; energy flow and mineral cycling (C, N, P); primary production and decomposition; structure and function of ecosystems: terrestrial (forest, grassland) and aquatic (freshwater, marine, estuarine). *in situ* conservation (endemism, biodiversity hotspots, protected areas); *ex-situ* conservation; conservation genetics (genetic diversity, inbreeding depression).

Unit-III

Organic evolution: Evidences of evolution (palaeontological, comparative anatomy, embryological, biogeographical and molecular evidences); natural selection and types of selection (stabilizing, directional, disruptive), industrial melanism and polymorphism.

Origin of life: Origin of micro-molecules, macromolecules, viruses, prokaryotes and eukaryotes speciation: isolation and its types.

Unit-IV

Population and Quantitative genetics: Origins of genetic variation; Mendelian genetics; Hardy-Weinberg equilibrium; drift; selection population genetics polygenic traits.

Molecular evolution Neutral theory; molecular clocks; rates of evolution; phylogenetic reconstruction; molecular systematics. Species concepts and speciation; adaptive radiation; convergence; biogeography.

Books Recommended:

1. Drickamer, L. C., Vessey, S. H., & Jakob, E. (2002). *Animal behavior: Mechanisms, ecology, evolution* (5th ed.). McGraw-Hill.
2. Jansma, R. (2016). *Global philosophical and ecological concepts*. Motilal Banarsidass Publishers.
3. Rastogi, V. B. (2022). *Organic evolution: Evolutionary Biology*. MedTech Science Press.
4. Sigmund, K. (2017). *Games of life: Explorations in ecology, evolution, and behavior*. Dover Publications.
5. Odum, E. P., and Barrett, G. W. (2005). *Fundamentals of ecology* (5th ed.). Cengage Learning India Private Limited
6. Smith, T. M., & Smith, R. L. (2015). *Elements of ecology*, Global Edition. Pearson Education.
7. Maynard Smith, J. (1993). *The theory of evolution*. Cambridge University Press.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8060
Course Title: Ecology and Evolution

(Practical)

COURSE OUTCOME:

After completion of this practical course, the learners will be to:

CO1: Identify ecological sampling methods, homologous and analogous structures, mimicry, and fossils related to ecology and evolution.

CO2: Explain the principles of quadrat analysis and water quality assessment using dissolved oxygen (DO) and total dissolved solids (TDS).

CO3: Perform ecological sampling and water quality analysis using standard laboratory techniques.

CO4: Analyze experimental observations and evolutionary evidence to interpret ecological patterns, adaptations, and evolutionary relationships.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8060
Course Title: Ecology and Evolution

(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiment:

1. To determine the minimum size of the quadrat by species area-curve method.
2. To measure amount of dissolved oxygen in pond water.
3. To determine the total dissolved solids (TDS) in water
4. Comparison of homologous and analogous structures
5. Demonstration of kinds of mimicry in various group of animals,
6. Study of fossils

Books Recommended:

1. Drickamer, L. C., Vessey, S. H., & Jakob, E. (2002). *Animal behavior: Mechanisms, ecology, evolution* (5th ed.). McGraw-Hill.
2. Kardong, K.V. (2018). *Vertebrates: Comparative anatomy, function, evolution* (8th ed.). McGraw-Hill Education.
3. Rastogi, V. B. (2022). *Organic evolution* (Evolutionary Biology). MedTech Science Press.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8062
Course Title: Plant Biotechnology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Explain the principles and applications of protoplast culture, somatic hybridization, cell suspension culture, secondary metabolite production, and cryopreservation of plant genetic resources.

CO2: Analyze plant gene organization, promoters, marker and reporter genes, and Agrobacterium-mediated genetic transformation using Ti/Ri plasmids and plant viral vectors.

CO3: Apply direct gene transfer methods, molecular screening techniques, and strategies for the development and maintenance of transgenic plants.

CO4: Evaluate the applications of transgenic plants in crop improvement, nutritional enhancement, stress tolerance, and biopharmaceutical production.

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Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8062
Course Title: Plant Biotechnology-II
(Theory)

Time: 3 Hours

Max. Marks: 100
Theory: 50

Practical: 20
CA: 30

L-T-P: 3-0-1

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit I

Protoplast isolation and culture, viability of protoplasts, protoplast fusion, selection of somatic hybrids and cybrids, applications of somatic cell hybridization.

Cell suspension culture, production of secondary metabolites by plant tissue culture, immobilized plant cell culture and use of bioreactors in secondary metabolite production.

Cryopreservation of germplasm: Short term and long term conservation of plant genetic resources.

Unit II

Organization of genes in plants; promoter and regulatory sequences; reporter genes, marker genes (scorable and selectable).

Genetic transformation of plants by *Agrobacterium tumefaciens* and *A. rhizogenes*, natural mode of infection, Ti/Ri plasmids, vir functions, binary and cointegrate vectors, features of transgene integration; use of plant viruses as vectors.

Unit-III

Direct DNA transfer/physical methods of gene transfer in plants: micro-projectile bombardment, electroporation, liposome mediated, calcium phosphate mediated etc; advantages and disadvantages; screening and selection of transformants: PCR and hybridization methods; transgene selection and silencing; generation and maintenance of transgenic plants.

Unit-IV

Applications of Transgenic Plants: Developing insect resistance, bacterial and fungal disease resistance, virus resistance and abiotic stress tolerance in plants. Improving food quality – nutritional enhancement of plants (carbohydrates, seed storage proteins and vitamins). Biopharming: plant cells as factories for production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines.

Books Recommended:

- 1.Plant Tissue Culture: An Introductory Text By Sant Saran Bhojwani, Prem Kumar Dantu • 2013
Publisher: Springer India
- 2.Introduction to Plant Tissue Culture M. K. Razdan • 2019 ISBN: 9788120417939 Publisher:
OXFORD & IBH PUBL
- 3.Plant Cell Culture: Essential Methods. Michael R. Davey, Paul Anthony • 2010 Publisher:Wiley

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8062
Course Title: Plant Biotechnology-II
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Explain the principles of micropropagation and the role of plant growth hormones in the preparation and optimization of culture media.

CO2: Apply aseptic tissue culture techniques to induce callus formation from different explants and establish cell suspension cultures.

CO3: Analyze the regeneration of shoots and embryos under different culture conditions and interpret the influence of growth regulators on morphogenesis.

CO4: Evaluate the applications of anther culture, ovary culture and embryo rescue techniques for plant improvement, haploid production and conservation of valuable germplasm.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8062
Course Title: Plant Biotechnology-II
(Practical)**

Time: 3 Hours

Practical Marks: 20

L-T-P: 0-0-1

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Micropropagation and its different steps.
2. Significance of growth hormones in culture medium.
3. Induction of callus from different explants.
4. To study regeneration of shoots/embryos.
5. Raising of cell suspension cultures.
6. Anther culture, ovary culture and embryo rescue

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8063
Course Title: Research Methodology
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the meaning, objectives, types, approaches and scientific methods of research and justify the importance of research methodology in scientific investigations.

CO2: Apply the research process by formulating research problems, identifying variables, developing hypotheses and selecting appropriate research designs.

CO3: Analyze quantitative and qualitative data using graphical representation techniques and interpret the significance of research findings.

CO4: Evaluate and prepare research reports using appropriate layouts, scientific writing conventions and internet-based research resources for literature search and publication activities.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8063
Course Title: Research Methodology
(Theory)

Time: 3 Hours

L-T-P: 3-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Research Aptitude: Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Research Methods versus Methodology, Research and Scientific Method, Importance of Knowing How Research is done

Unit-II

Research Process: Reviewing the literature, Formulation of research problem, Nature and type of variables, Hypothesis- meaning, types, development of hypothesis and its testing, Meaning & Functions of Research Design

Unit-III

Data Analysis: Sources, acquisition and interpretation of data, Quantitative and qualitative data, Graphical representation and mapping of data, Significance of Report Writing: Different Steps in writing Report, Layout of the Research Report, Types of Reports, Mechanics of Writing a Research Report,

Unit-IV

Use of Internet in Research Work: Use of internet networks in research activities in searching material, paper downloading, submission of papers, relevant websites for journals and related research work.

Books recommended:

1. Kothari, C. R. (2017). research methodology methods and techniques by CR Kothari. *Published by New Age International (P) Ltd., Publishers, 91.*
2. Winston, W. (2016). *Microsoft Excel data analysis and business modeling.* Microsoft press.

3. Kumar, R. (2018). Research methodology: A step-by-step guide for beginners.
4. Dawson, D. C. (2002). *A practical research methods*. How to Books limited.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8063
Course Title: Research Methodology
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Analyze recent research case studies and critically interpret research objectives, methodology, results and conclusions.

CO2: Apply literature search tools such as Google Scholar and PubMed to prepare a structured review of literature on a selected scientific topic.

CO3: Create graphical representations of experimental or arbitrary data using bar charts, histograms, pie charts and scatter plots and interpret the analytical outcomes.

CO4: Develop a concise research project proposal integrating problem identification, objectives, hypothesis, methodology, expected outcomes and references.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8063
Course Title: Research Methodology
(Practical)

Instructions for the practical Examiner:

Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

Experiments:

1. Analyze short case studies of based on any latest research paper.
2. Write review of literature (2000 words or more) on a specific topic using various tools viz. scholar google, PUBMED, etc.
3. Based on an arbitrary data, prepare graphs (bar charts, histograms, pie charts, scatter plots) and analyse data
4. Write a small research project proposal cumulating all aspect of research methodology

Books recommended:

1. Kothari, C. R. (2017). research methodology methods and techniques by CR Kothari. *Published by New Age International (P) Ltd., Publishers, 91.*
2. Winston, W. (2016). *Microsoft Excel data analysis and business modeling.* Microsoft press.
3. Kumar, R. (2018). Research methodology: A step-by-step guide for beginners.
4. Dawson, D. C. (2002). *A practical research methods.* How to Books limited.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30**

**Course Code: BBTM-8064
Course Title: Immunology-II
(Theory)**

**Time: 3 Hours
L-T-P: 3-0-1**

**Max. Marks: 100
Theory: 50
Practical: 20
CA: 30**

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain T-cell subsets, surface markers, T-dependent and T-independent antigens, antigen recognition by T-cells and the production and applications of monoclonal antibodies.

CO2: Apply immunological techniques such as immunodiffusion, immunoelectrophoresis, ELISA, RIA, agglutination and haemagglutination assays for detection and analysis of antigens and antibodies.

CO3: Analyze immune responses against viruses, intracellular and extracellular bacteria and parasites, including mechanisms of immune evasion and immunopathological consequences of infections.

CO4: Evaluate different vaccination strategies including active and passive immunization, adjuvants, recombinant vaccines, synthetic peptide vaccines, multivalent vaccines and DNA vaccines for disease prevention.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8064
Course Title: Immunology-II
(Theory)

Time: 3 Hours
L-T-P: 3-0-1

Max. Marks: 100
Theory: 50
Practical: 20
CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

T-cell subsets and surface markers, T-dependent and T-independent antigens, recognition of antigens by T- cells. Monoclonal antibodies: its production and uses.

Unit-II

Various types of immunodiffusions and immunoelectrophoretic procedures. ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and haemagglutination inhibition.

Unit-III

Immunity to viruses, intracellular and extracellular bacteria, immunopathological consequences of parasitic infections, immune invasion, mechanism used by parasites, regulation of immune invasion, mechanism used by parasites.

Unit-IV

Active and passive immunization, Adjuvants, whole organism vaccine, purified macromolecules as vaccine, recombinant antigen vaccine, recombinant vector vaccine, synthetic peptide vaccine, multivalent subunit vaccine, DNA Vaccine

Books Recommended:

1. Murphy, K., & Weaver, C. (2017). *Janeway's immunobiology*. 9th edition. Garland science.
2. Owen, J., Stranford S.A., Jones P.P., Owen J.A. (2018). *Kuby immunology*. New York: W.H. Freeman, Macmillan Learning.
3. Abbas, A. K., Lichtman, A. H., Pillai, S., Henrickson S. (2025). *Cellular and molecular immunology* (11th ed.). Elsevier.
4. Flajnik, M. (2022). *Paul's fundamental immunology*. Lippincott Williams & Wilkins.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8064
Course Title: Immunology-II
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Prepare and interpret a child vaccination chart, differentiating between mandatory and optional vaccines and explaining their immunological significance.

CO2: Perform haemagglutination and haemagglutination inhibition assays using standard laboratory procedures and record the experimental observations accurately.

CO3: Analyze antigen–antibody interactions through single and double immunodiffusion tests and distinguish line of identity, partial identity and non-identity.

CO4: Evaluate direct and indirect ELISA results for qualitative or quantitative detection of antigens or antibodies and interpret their diagnostic significance.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8064
Course Title: Immunology-II
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments

1. Preparation of vaccine chart of child, highlighting optional vaccines
2. Haemagglutination assay
3. Haemagglutination inhibition assay
4. Double immunodiffusion test using specific antibody and antigen Line of identity, partial identity and non identity
5. Single immunodiffusion test using specific antibody and antigen
6. Direct and indirect ELISA

Books Recommended:

1. Miller, L. E., & Stevens, C. D. (2023). Clinical immunology and serology.
2. Celis, J.E. (2021). Cell Biology: A laboratory handbook Amsterdam; Boston: Elsevier Academic
3. Hay, F.C. Westwood O.M.R. (2002). Practical Immunology, 4th Ed., Blackwell Science, U.K.

**Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30**

**Course Code: BBTM-8060
Course Title: Industrial Biotechnology-II
(Theory)**

**Time: 3 Hours
L-T-P: 3-0-1**

**Max. Marks: 100
Theory: 50
Practical: 20
CA: 30**

COURSE OUTCOMES:

Upon successful completion of this course, the learners will be able to:

CO1: Explain the principles and industrial production processes of antibiotics, enzymes, solvents, vermicomposting, biofertilizers and biocontrol agents used in industrial biotechnology.

CO2: Analyze microbial fermentation processes involved in the production of fermented foods, organic acids, vitamins, amino acids, single cell protein, alcoholic beverages and the significance of mycotoxins.

CO3: Apply biotechnological approaches for fuel production, transgenic crop utilization, microbial soil treatment, biogas generation and biodegradation of xenobiotic compounds.

CO4: Evaluate the role of biological nitrogen fixation, diazotrophs, microbial associations and nitrogen-fixing microorganisms in sustainable agriculture and environmental management.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30

Course Code: BBTM-8060
Course Title: Industrial Biotechnology-II
(Theory)

Time: 3 Hours

L-T-P: 3-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 10 marks.

Unit-I

Antibiotics production: Penicillin and Streptomycin, Enzymes production: amylases and cellulases, solvent production: Acetone, butanol and ethanol. Vermicomposting, Microbial inoculants and production of bacterial biofertilizers, Biocontrol agent and their significance.

Unit-II

Fermented foods: Sauerkraut and pickles, organic acids: production of citric Acid and acetic acid, microbial production of vitamins: vitamin-B12 and vitamin-C, amino acids: Glutamic acid and lysine, single cell protein: spirulina production, alcohols: wine & beer, and mycotoxins (Aflatoxins).

Unit-III

Fuel Biotechnology, transgenic crops (BT cotton and maize) and their potentials in agro industry, soil treatment with microbes, Mycorrhizal fungi, Biogas production, Biodegradation of xenobiotic compound.

Unit-IV

BNF and its significance, diazotrophes and their characterization, Microbial association and their interaction with plants, nitrogen cycle and role of Nitrogen fixing microbes in sustainable agriculture.

Books Recommended:

1. Wittmann, C. and Liao, J. (2017). Industrial Biotechnology: Products and Processes (Advanced Biotechnology), Vol. 4 Wiley-VCH.
2. Singh B.D. (2016). Biotechnology: Expanding horizons, Kalyani Publishers / Lyall Bk Depot
3. Chakraborty, P.K. (2013). Agro and Industrial Biotechnology, Black Prints
4. Tyagi, N. (2012). Industrial Microbiology and Biotechnology, Agrotech Press.

5. Casida, L.E.J.R. (2007). Industrial Microbiology, New Age International Publishers
6. Okafor N, Okeke B.C. (2018). Modern Industrial Microbiology and Biotechnology, 2nd edition, CRC Press.
7. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
8. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5th Edition, The Benjamin / Cummings Publishing Company, Inc.
9. Stanier, R.Y. (1995). General microbiology, MacMillan Press, London.
10. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
11. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
12. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBS Publishers & Distributors.
13. Purohit, S.S. (2000). Microbiology: Fundamentals and Applications (6th Edition), Agrobios (India).
- Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
14. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.
15. Stanbury, P.F., Whitaker, A. and Hall, S.J. (2001), Principles of Fermentation Technology 2nd ed., Pergamon Press, Oxford.
16. Frazier, W.C. and Westhoff, D.C. (2003) Food Microbiology. 18th Edition, Tata McGraw Hill, Inc., New York.
17. Industrial Biotechnology: Approach to Clean Technology · Jogdand, S.N. Himalaya Publishing House 2006. ISBN: ISBN number: 9788183184250

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8060
Course Title: Industrial Biotechnology-II
(Practical)

COURSE OUTCOMES:

Upon successful completion of this practical course, the learners will be able to:

CO1: Perform screening, isolation and identification of cellulolytic and food spoilage microorganisms using standard microbiological techniques.

CO2: Analyze the additive, synergistic and minimum inhibitory concentration (MIC) effects of antibiotics on selected microorganisms.

CO3: Demonstrate microbial enumeration of milk samples and assess milk quality using MBRT and related microbiological methods.

CO4: Evaluate microbial contamination in food and dairy samples and interpret the significance of the results for food safety and public health.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-VIII
Batch: 2026-30
Course Code: BBTM-8060
Course Title: Industrial Biotechnology-II
(Practical)

Time: 3 Hours

Practical Marks: 20

Instructions for the practical Examiner: Question paper is to be set on the spot jointly by the internal and external examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Experiments

1. Screening of cellulose producing microorganism from wood degrading soil.
2. Additive and Synergistic effect of two antibiotics on the above microorganism.
3. Minimum inhibitory concentration of a antibiotics for the above microorganism.
4. Plating the milk samples for microbial counting.
5. MBRT Test for determination of milk quality.
6. Isolation and identification of microbes from spoiled food sample.

Books Recommended:

1. Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory (Pearson Benjamin Cummings).
Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Harlow, Addition-Wesley.
2. Plummer D.T. (2006). An introduction to practical biochemistry (Tata McGraw Hill Publishers Co. Ltd., New Delhi).
3. Bansal, D.D. (1985). Practical biochemistry (Standard Publication Chandigarh).