

ANNEXURE B

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-IV)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26



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
Session: 2025-26
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	4-0-2	4	0	1	5	50	20	30	100
BBTM-1074	Botany-I	DSC	4-0-2	4	0	1	5	50	20	30	100
BBTM-1345	General Microbiology-I	DSC	4-0-2	4	0	1	5	50	20	30	100
VACF-1491	*Foundation Course	VAC	2-0-0	2	0	0	2	35	-	15	50
Total Credits							25				

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

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
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Session: 2025-26
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	AEC	3-0-2	3-0-1	4	50	20	30	100
BBTM -2063	Genetics	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-2484	Cell Biology	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-2065	Fundamentals of Biotechnology	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-2060	Industrial Biotechnology -I	SEC	2-0-2	2-0-1	3	50	20	30	100
VACD-2161	*Drug abuse and ethical education	VAC	4-0-0	4-0-0	4	70	-	30	100
Total Credits					28				

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 Course

VAC: Value Added Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF FOUR YEAR DEGREE PROGRAMME
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Session: 2025-26
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	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-3483	Zoology-I	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-3064	Immunology-I	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-3085	Chemistry-I	MDC	3-0-2	3-0-1	4	50	20	30	100
VACE 3221	*Environmental Studies (Compulsory)	VAC	1-0-2	1-0-1	2	20	15	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
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
Session: 2025-26
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	4-0-2	4-0-1	5	50	20	30	100
BBTM-4062	Biochemical and Biophysical Techniques-I	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-4073	Botany-II	DSC	3-0-2	3-0-1	4	50	20	30	100
BBTM-4084	Biochemistry-II	DSC	4-0-2	4-0-1	5	50	20	30	100
BBTM-4085	Chemistry-II	MDC	3-0-2	3-0-1	4	50	20	30	100
BBTM-4060	Skill development in Biotechnology-I	SEC	2-0-2	2-0-1	3	50	20	30	100
VACG-4531	*Gender sensitization	VAC	1-0-2	1-0-1	2	20	15	15	50
Total Credits					28				

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

DSC: Discipline Specific Courses

MDC: Multidisciplinary course

SEC: Skill Enhancement Course

VAC: Value Added Course

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Session: 2025-26
Course Code: BBTM-1083
Course Title: Biochemistry-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Gain basic knowledge about the role of pH and the physiological properties of water in biological systems.

CO2: Acquire the knowledge of carbohydrates, classification, and their biological functions

CO3: Understand the definition, structure and biological functions of lipids and their subclasses.

CO4: Understand the definition, structure, biological functions, and classification of proteins.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-I
Session: 2025-26
Course Code: BBTM-1083
Course Title: Biochemistry-I
(Theory)

Time: 3 Hrs.

Max. Marks: 100

L-T-P: 4-0-1

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. 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 , pK_a , Hasselbach Hendersson equation and its implications.

Unit-II

Carbohydrates: Introduction, 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. Voet, D., Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5th Edition, Wiley.
2. Stryer, L. (2015). Biochemistry, 8th Edition, W.H. Freeman and Company, New York
3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2019). Biochemistry, 9th Edition, Freeman.
4. Mathew, C.K., Van, K.E. and Anthern, K.G. (2012). Biochemistry 4th Edition, Addison Wesley.
5. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7th Edition, CBS Publishers and Distributors, New Delhi.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
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Semester-I
Session: 2025-26
Course Code: BBTM-1083(P)
Course Title: Biochemistry-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform Beer Lamberts Law

CO2: Determine pKa value while performing practical

CO3: Estimate carbohydrates in the given sample

CO4: Estimate proteins and fats in the sample by different methods

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

Session: 2025-26

Course Code: BBTM-1083(P)

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

Time: 3 Hrs.

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. Protein estimation by Biuret method.
8. The determination of acid value of a fat.
9. The determination of saponification value of a fat.

Books Recommended:

1. Plummer D.T. (2017). An Introduction to Practical Biochemistry, 3rd Edition Tata McGraw Hill Education.
2. Sawhney, S.K. and Singh, R. (2014). Introductory Practical Biochemistry, Narosa Publishing House.
3. Wilson, K. And Walker, J. (2018). Principles and Techniques of Biochemistry, 8th Edition, McGraw Hill Education.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
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Semester-I
Session: 2025-26
Course Code: BBTM-1345
Course Title: General Microbiology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Know the contribution of microbiologists and general features of various microbes.

CO2: Study the structure of bacteria cell and bacterial classification

CO3: Study the microbial culture collection centers, microbial preservation and sterilization methods and understand the basic concepts of bacterial nutrition.

CO4: To learn different types of microscopy techniques.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
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Semester-I
Session: 2025-26
Course Code: BBTM-1345
Course Title: General Microbiology-I
(Theory)

Time: 3 Hrs.

Max. Marks: 100

L-T-P: 4-0-1

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. 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 microbial preservation: Refrigeration, cryopreservation, lyophilization, Paraffin method. Basic concept of microbial growth, physiology of micro organisms, 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. Stanier, R.Y. (1999). General microbiology, MacMillan Press, London.
3. Tortora, G.J., Funke, B.R. and Case, C.L. (2015). Microbiology: An introduction, 12th Edition, Pearson College Div.
4. Willey, J., Sherwood, L. And Wooverton, C. J. (2017). Prescott's Microbiology, 10th Edition, McGraw-Hill Education/ Asia
5. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. (2010). Microbiology: An application-based approach, Tata McGraw Hill.
6. Purohit, S.S. (2006). Microbiology: Fundamentals and Applications, 7th Edition, Agrobios (India).

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Semester-I
Session: 2025-26
Course Code: BBTM-1345(P)
Course Title: General Microbiology-I
(Practical)**

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand sterilization techniques of different types of materials.

CO2: Learn methods of isolation and identification of bacteria

CO3: Learn methods of detection of microbes.

CO4: Understand preservation methods of microbes.

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

Session: 2025-26

Course Code: BBTM-1345(P)

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

Time: 3 Hrs.

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 and its equipments.
2. Cleaning of glassware.
3. Preparation of cotton plugs
4. Preparation of media, and aseptic techniques of sterilization.
5. Isolation of micro-organism from air, water and soil samples. Dilution, spread plating and pour plating, Colony purification.
6. Identification of bacteria by simple staining, negative staining, and Gram staining.
7. Detection of specific bacteria by Wet mount preparation method and Hanging drop mount method.
8. To preserve bacteria by short term preservation methods like direct transfer to subculture, Immersion in oil, cryopreservation.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Pearson Education India.
2. Dubey R.C. and Maheshwari (2012). Practical Microbiology 5th edition: S. Chand and company ltd. New Delhi.
3. Leooffee, M.J. and Pierce, B.E. (2015). Microbiology: Laboratory Theory and Application, 3rd Edition, Morton Pub. Co.
4. Sastry, A.S. and Bhat, S. (2018). Essentials of Practical microbiology. Jaypee Brothers Medical Publishers.

Semester-II

Bachelor of Science (Bio-Technology) Three Year Degree Programme
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Semester-II
Session: 2025-26
Course Code: BBTM-2063
Course Title: Genetics
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Understand Mendelian and Neo-mendelian genetics along with the study of phenomenon of dominance, laws of segregation, independent assortment of genes
- CO2:** Develop an understanding of the principles and mechanisms of linkage and crossing over.
- CO3:** To learn various types of mutations their significance and practical applications along with basic microbial genetics
- CO4:** Understand the organization of chromosomes and concept of human genetics

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Semester-II

Session: 2025-26

Course Code: BBTM-2063

Course Title: Genetics
(Theory)

Time: 3 Hours
L-T-P: 4-0-1

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

Instructions for the Paper Setter: 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. 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, centromere, and telomere structure, 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., Cochrane, B. (2017). Genetics: Analysis of Genes & Genomes 9th Edition. Jones & Bartlett Publishers.
3. Brooker, R.J. (2017). Genetics: Analysis and Principles, McGraw-Hill Education.
4. Pierce, B. (2016). Genetics: A conceptual approach, 6th Edition, WH Freeman.
5. Snustad and Simmons (2015). Principles of Genetics, 7th Edition, John Wiley & Sons

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Semester-II
Session: 2025-26
Course Code: BBTM-2063(P)
Course Title: Genetics
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand Mendelian laws.

CO2: Solve paternity disputes.

CO3: Demonstrate segregation in preserved material.

CO4: Study polytene chromosomes and dermatoglyphics.

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Semester-II
Session: 2025-26
Course Code: BBTM-2063(P)
Course Title: Genetics
(Practical)

Time: 3 Hrs.

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.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
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Semester-II
Session: 2025-26
Course Code: BBTM-2065
Course Title: Fundamentals of Biotechnology
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

CO1: Know the basic concept of biotechnology and recombinant technology.

CO2: Understand applications of biotechnology in health care and agriculture.

CO3: Know the bio business and intellectual property rights in biotechnology.

CO4: Know different ethical issues pertaining to biotechnology.

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Semester-II
Session: 2025-26
Course Code: BBTM-2065
Course Title: Fundamentals of Biotechnology
(Theory)

Time: 3 Hours
L-T-P: 4-0-1

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

Instructions for the Paper Setter: 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. 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 and areas of biotechnology, Overview - DNA, gene, gene expression, Recombinant DNA technology. 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); careers and employment opportunities in biotechnology.

UNIT-III

Bio business and IPRs in Biotechnology

Commercialization of biotechnology: concerns and consequences, biotechnology industry practices and Government regulations, concept and market potential of Bio business, 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. IPR: introduction, types (trade secret, copyright, trademark)

UNIT-IV

Biotechnology and Society

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.

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.

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Semester-II
Session: 2025-26
Course Code: BBTM-2065(P)
Course Title: Fundamentals of Biotechnology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn good lab practices in biotechnology laboratory.

CO2: Learn principle, working and applications of instruments.

CO3: Know the handling and disposal procedure regarding hazardous reagents.

CO4: Know different steps in patent writing.

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Semester-II
Session: 2025-26
Course Code: BBTM-2065(P)
Course Title: Fundamentals 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.

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Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Session: 2025-26
Course Code: BBTM-2060
Course Title: Industrial Biotechnology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the basics of microbial industrial processes.

CO2: Understand the isolation, maintenance, and preservation of industrially important microbes

CO3: Understand different strain improvement method required for industrial important microbes

CO4: Understand industrial production of primary and secondary metabolite and fermentation of dairy products, fermented foods, and enzymes.

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

Session: 2025-26

Course Code: BBTM-2060

**Course Title: Industrial Biotechnology-I
(Theory)**

Time: 3 Hours

L-T-P: 2-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setter: 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. Each question carries 10 marks.

Unit-I

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.

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.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Session: 2025-26
Course Code: BBTM-2060(P)
Course Title: Industrial Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate milk protein and determine fat content in milk

CO2: Learn the process of cheese making

CO3: Isolate microbes from soil

CO4: Screen industrially important enzyme producing microbes

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-II
Session: 2025-26
Course Code: BBTM-2060(P)
Course Title: Industrial Biotechnology-I
(Practical)

Time: 3 Hrs

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.

Semester-III

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Session: 2025-26
Course Code: BBTM-3061
Couse Title: Gene Structure and Function
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Understand the structure of DNA, RNA, gene organization, genome complexity, and repetitive DNA elements.
- CO2:** Understand the types, characteristics, and applications of transposable elements.
- CO3:** Understand the regulation of gene expression in prokaryotes through operon models.
- CO4:** Understand the genetic basis of cancer and the key outcomes of the Human Genome Project.

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

Session: 2025-26

Course Code: BBTM-3061

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

Time: 3 Hrs.

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 (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. 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), Genome size and Genome complexity: C value and C value paradox, pseudogenes, intergenic sequences, satellite and repetitive, DNA.

UNIT-II

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.

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. Damal. J, Lodish, H. and Baltimore, D. (2007). Molecular Cell Biology, 6th edition, Scientific American Books, Distributed by W.H. Freeman and Co., New York.
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. Lewin, B. (2007). Gene IX, 9th edition, Jones and Bartlett Publishers.
4. Nelson, D. L. & Cox, M. M. (2005). Lehninger Principles of Biochemistry, 4th ed., Worth Publishers, New York
5. Freifelder, D. (2000). Microbial Genetics, Narosa Publishing House.
6. Research Papers

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Session: 2025-26
Course Code: BBTM-3061 (P)
Couse Title: Gene Structure and Function
(Practical)

Time: 3 Hrs.

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.

1. Isolation of DNA from plant samples
2. Spectrophotometric analysis of DNA.
3. Analysis of DNA by PAGE
4. To study enzyme activity by Native – PAGE
5. To study proteins by SDS-PAGE.

Books recommended:

1. Damal. J, Lodish, H. and Baltimore, D. (2007). Molecular Cell Biology, 6th edition, Scientific American Books, Distributed by W.H. Freeman and Co., New York.
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. Lewin, B. (2007). Gene IX, 9th edition, Jones and Bartlett Publishers.
4. Nelson, D. L. & Cox, M. M. (2005). Lehninger Principles of Biochemistry, 4th ed., Worth Publishers, New York.
5. Freifelder, D. (2000). Microbial Genetics, Narosa Publishing House.
6. Research Papers

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Session: 2025-26
Course Code: BBTM-3064
Course title: Immunology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Familiarize with the types and features of immune system
- CO2:** Understand the roles of various immune cells and organs involved in immune responses
- CO3:** Inculcate knowledge of antigen-antibody interactions, immunogenicity, immunoglobulin structure and classes, and the complement system.
- CO4:** Understand the structure and function of MHC class I and II molecules, and their role in T and B cell-mediated immune response.

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

Session: 2025-26

Course Code: BBTM -3064

Couse Title: Immunology-I
(Theory)

Time: 3 Hrs.

L-T-P: 4-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setter: 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. 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 epitioe), 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.Roitt, I.M. Brostoff, J. and Male, D.K. (2012), Immunology, 8th Edition, Elsevier, New York
- 2.Judy Owen, Jenni Punt, Sharon Stranford, Patricia Jone. (2018), Immunology, 7th Edition. W.H. Freeman and Company, New York
- 3.Abul K. Abbas, Andrew H. H. Lichtman, Shiv Pillai (2011) Cellular and Molecular Immunology; 7th Edition, Saunders
- 4.Doan (2012) Lippincott's Illustrated Reviews Immunology; 2nd Edition, Wolters Kluwer India Pvt.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Session: 2025-26
Course Code: BBTM-3064 (P)
Couse Title: Immunology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform total and differential leucocyte counts to assess immune status.

CO2: Accurately estimate total red blood cell (RBC) count using standard laboratory techniques.

CO3: Demonstrate the ability to collect blood samples through different methods and separate plasma effectively.

CO4: Conduct haemagglutination and haemagglutination inhibition assays to study antigen-antibody interactions.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-III
Session: 2025-26
Course Code: BBTM-3064 (P)
Couse Title: Immunology-I
(Practical)

Time: 3 Hrs.

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.

1. Collection of blood sample by different method.
2. Blood group testing
3. Differential leucocytes count
4. Total Leucocytes count
5. Total RBC count
6. Separation of Plasma from blood
7. Isolation of mononuclear cells from peripheral blood and to check their viability by dye exclusion method.
8. Separation and purification of Ig G antibodies from serum using protein A column

Books Recommended:

1. Stevans, C.D. (1996). Clinical Immunology and Serology: A Laboratory Perspective F.A. Davis Company, Philadelphia
2. Celis, K.E. (1998). Cell Biology: A laboratory handbook. Vol-I Academic Press, U.K.
3. Hay, F.C. Westwood O.M.R. (2002). Practical Immunology, 4th Ed., Blackwell Science, U.K.

Semester-IV

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4061
Couse Title: Molecular Biology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the structure of DNA, experimental evidence supporting DNA as genetic material, and the mechanism of DNA replication in prokaryotes and eukaryotes.

CO2: Explain the structure and functions of various RNAs, the transcription process in prokaryotes and eukaryotes, and post-transcriptional modifications.

CO3: Describe the genetic code, the process of protein synthesis and post-translational modifications, and the action of translation inhibitors.

CO4: Understand DNA recombination mechanisms, types and causes of mutations, and their significance and applications in genetics.

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

Session: 2025-26

Course Code: BBTM-4061

**Couse Title: Molecular Biology
(Theory)**

Time: 3 Hrs.

L-T-P: 4-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setter: 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. 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 replication: Types of replications (conservative, semiconservative and dispersive) Meselson and Stahl experiment of replication. Mechanism of replication in Prokaryotes and eukaryotes

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), post transcriptional modifications (capping, polyadenylation, and RNA splicing) inhibitors of transcription

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 recombination: general overview of types of DNA recombination- homologous, non-homologous, site specific and replicative recombination) Holliday model of recombination. 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.

Books Recommended:

1. George M. Malacinski (2015) *Freifelders Essentials Of Molecular Biology*, 4th/Ed, Jones & Bartlett
2. David P. Clark, Nanette J. Pazdernik, Michelle R. McGehee (2018), 3rd edition, *Molecular Biology*, Academic Cell
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
Session: 2025-26
Course Code: BBTM-4061 (P)
Couse Title: Molecular Biology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Acquire skills in preparing stock solutions for molecular biology experiments.

CO2: Demonstrate the ability to isolate genomic DNA from plant tissues using standard protocols.

CO3: Set up agarose gel electrophoresis apparatus and prepare gels for DNA separation.

CO4: Analyze DNA concentration and purity using spectrophotometric and fluorometric methods.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4061 (P)
Couse Title: Molecular Biology
(Practical)

Time: 3 Hrs.

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.

1. Preparation of stock solutions.
2. Isolation of genomic DNA from plants.
3. RNA isolation from plants.
4. Spectrophotometric determination of concentration and purity of DNA and RNA.
5. Quantification of DNA by spectrophotometric and fluorometric (Ethidium bromide) analysis
6. Gel casting and setting up of gel apparatus.
7. 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 TA, Genomes, 3rd ed. Garland Science 2006

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4062
Couse Title: Biochemical and Biophysical Techniques-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the principles, types, and applications of centrifugation techniques.

CO2: Explain the theory and principles of basic chromatographic methods.

CO3: Illustrate the principles and applications of advanced chromatographic techniques.

CO4: Understand the principles of spectroscopy.

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

Session: 2025-26

Course Code: BBTM-4062

Couse Title: Biochemical and Biophysical Techniques-I
(Theory)

Time: 3 Hrs.

L-T-P: 4-0-1

Max. Marks: 100

Theory: 50

Practical: 20

CA: 30

Instructions for the Paper Setter: 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. 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 ES.

Books Recommended:

- 1.Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
- 2.Sheehan, D. (2000). 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. Boye R (2006) Modern Experimental Biochemistry, Pearson Education, Asia, New
7. 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
Session: 2025-26
Course Code: BBTM-4062 (P)
Couse Title: Biochemical and Biophysical Techniques-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the concept of centrifugation.

CO2: Perform separation of biomolecules using paper and thin layer chromatography techniques.

CO3: Apply ion-exchange chromatography for effective separation and purification of proteins.

CO4: Utilize affinity chromatography for specific protein separation based on molecular interactions.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4062 (P)
Couse Title: Biochemical and Biophysical Techniques-I
(Practical)

Time: 3 Hrs.

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.

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. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Sheehan, D. (2000). 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. Boye R (2006) Modern Experimental Biochemistry, Pearson Education, Asia, New
7. 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
Session: 2025-26
Course Code: BBTM-4084
Couse Title: Biochemistry-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Understand basic metabolic pathways and energy flow in biological systems.
- CO2:** Explain the role of ATP and biological oxidation in metabolism.
- CO3:** Describe enzyme structure, function, and catalytic mechanisms.
- CO4:** Interpret enzyme kinetics and types of enzyme inhibition.

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

Session: 2025-26

Course Code: BBTM-4084
Couse Title: Biochemistry-II
(Theory)

Time: 3 Hrs.
L-T-P: 4-0-1

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

Instructions for the Paper Setter: 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. 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, Compartmentation, and Interorgan metabolism

UNIT-II

ATP: Structure, Free energy change, energy coupling with ATP (Creatinine phosphokinase, Adenylate kinase), metabolic roles of ATP; Energy rich metabolites, biological oxidation – Reduction reactions electron transport chain, calculation of ATP during metabolic processes

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.

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.

Books Recommended:

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7th ed, WH Freeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry, 9th Ed., WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters Kluwer India Pvt. Ltd.
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
Session: 2025-26
Course Code: BBTM-4084 (P)
Couse Title: Biochemistry-II
(Practical)

COURSE OUTCOMES:

CO1: Estimate the activity of enzymes like alpha-amylase and acid phosphatase from biological samples.

CO2: Study the effect of temperature and pH on enzyme activity.

CO3: Perform quantitative estimation of catalase activity in plant tissues.

CO4: Develop practical skills in enzyme assay techniques and data interpretation.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4084 (P)
Couse Title: Biochemistry-II
(Practical)

Time: 3 Hrs.

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.

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. Quantitative estimation of catalase activity in mung beans
6. Determination of K_m for acid phosphatase
7. Competitive and non-competitive inhibition

Books Recommended:

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7th ed, WH Freeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry, 9th Ed., WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters Kluwer India Pvt. Ltd.
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
Session: 2025-26
Course Code: BBTM-4060
Couse Title: Skill Development in Biotechnology-II
(Theory)

COURSE OUTCOMES:

CO1: Understand the types, role, and production techniques of biofertilizers and biological nitrogen fixation.

CO2: Gain knowledge of medicinal plants, phytochemicals, essential oils, and their applications.

CO3: Learn the basics of nutraceuticals, functional foods, and their health benefits and regulations.

CO4: Develop entrepreneurial insight into bioindustries, including business planning, funding, and market strategies.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4060
Couse Title: Skill Development in Biotechnology-II
(Theory)

Time: 3 Hrs.
L-T-P: 2-0-1

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

Instructions for the Paper Setter: 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. 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, Levender, 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

Bioentrepreneurship

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. Fundamentals of Foods, Nutrition and Diet Therapy, (English, Mudambi Sumati R.), New Age

International publication,

2. Clinical Dietetics and Nutrition, by Antia F P (Author), Oxford publication.
3. Alpers.D.H. , Stenson W.F.and Bier.D.M., (2002). Manual of Nutritional Therapeutics, 4th edition, Lippincott Williams & Wilkins, Philadelphia, USA.
4. Research paper and e notes.
5. F. Bakkali, S. Averbeck , D. Averbeck, M. Idaomar. (2008). Biological effects of essential oils– A review. Food and Chemical Toxicology 46: 446–475.
6. R. Amorati,M. C. Foti, L. Valgimigli. (2013). Antioxidant Activity of Essential Oils. Journal of Agriculture and Food Chemistry. 61:10835–10847.
7. A Sharma, D.S. Cannoo. (2016). Comparative evaluation of extraction solvents/techniques for antioxidant potential and phytochemical composition from roots of *Nepeta leucophylla* and quantification of polyphenolic constituents by RP-HPLC-DAD. Food Measure. Doi 10.1007/s11694- 016-9349-5
8. Sharma and D. S. Cannoo. (2013). Phytochemical composition of essential oils isolated from different species of genus *NEPETA* of Labiatae family: a review. Pharmacophore, 4 (6): 181-211.
9. Sarikurkcü, B. Tepe, D. Daferera, M. Polissiou, Mansur Harmandar. (2008). Studies on the antioxidant activity of the essential oil and methanol extract of *Marrubium globosum* subsp. *globosum* (Lamiaceae) by three different chemical assays. Bioresource Technology, 99: 4239–4246.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: BBTM-4060 (P)
Couse Title: Skill development in Biotechnology-I
(Practical)

COURSE OUTCOMES:

CO1: Isolate and culture *Rhizobium* for biofertilizer production.

CO2: Extract and analyze essential oils using distillation and chemical assays.

CO3: Evaluate antioxidant potential and phytochemical content of essential oils.

CO4: Assess the antimicrobial activity of essential oils against microbial strains.

Bachelor of Science (Bio-Technology) Three Year Degree Programme
Bachelor of Science (Honours) Bio-Technology Four Year Degree Programme
Semester-IV
Session: 2025-26
Course Code: 4060 (P)
Couse Title: Skill development in Biotechnology-I
(Practical)

Time: 3 Hrs.

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.

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. Fundamentals of Foods, Nutrition and Diet Therapy, (English, Mudambi Sumati R.), New Age International publication,
2. Clinical Dietetics and Nutrition, by Antia F P (Author), Oxford publication.
3. Alpers.D. H., Stenson W.F.and Bier.D. M., (2002). Manual of Nutritional Therapeutics, 4th edition, Lippincott Williams & Wilkins, Philadelphia, USA.
4. Research pare and e notes.
5. F. Bakkali, S. Averbeck, D. Averbeck, M. Idaomar. (2008). Biological effects of essential oils – A review. Food and Chemical Toxicology 46: 446–475.

ANNEXURE C

FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Bachelor of Science Bio-Technology (Semester: V-VI)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26



**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 THREE YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology)
Session: 2025-26
Semester-V

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL 5061	rDNA Technology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5062	Animal Biotechnology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5063	Plant Biotechnology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5064	Bioprocess Engineering-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5065	Biochemical and Biophysical Techniques-I	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-5066	Industrial Biotechnology-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTP-5061	Lab in rDNA Technology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5062	Lab in Animal Biotechnology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5063	Lab in Plant Biotechnology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5064	Lab in Bioprocess Engineering-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5065	Lab in Biochemical and Biophysical Techniques-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5066	Lab in Industrial Biotechnology-II	C	0-0-2	0-0-1	1	-	20	5	25
VACP-5551	*Job readiness Course	VAC	2-0-0	2-0-0	2	40	-	10	50
Total Credits					24				

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

C-Compulsory

VAC: Value Added Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME
Bachelor of Science (Bio-Technology)
Session: 2025-26
Semester-VI

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL-6061	rDNA Technology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6062	Animal Biotechnology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6063	Plant Biotechnology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6064	Bioprocess Engineering-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6085	Chemistry-III	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-6066	Biochemical and Biophysical Techniques-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTP-6061	Lab in rDNA Technology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6062	Lab in Animal Biotechnology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6063	Lab in Plant Biotechnology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6064	Lab in Bioprocess Engineering-II (Industrial Training)	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6085	Lab in Chemistry-III	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6066	Lab in Biochemical and Biophysical Techniques-II	C	0-0-2	0-0-1	1	-	20	5	25
Total Credits					22				

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

B.Sc. Bio-Technology Semester-V

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5061
Course title: rDNA Technology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Describe the role of DNA modifying enzymes in genetic engineering.

CO2: Explain various cloning vectors and selection methods in *E. coli*.

CO3: Apply blotting and transformation techniques in molecular biology.

CO4: Compare labeling methods and detection systems for DNA/RNA probes.

Bachelor of Science (Bio-Technology) Semester-V

Session: 2025-26

Course Code: BBTL-5061

**Course title: rDNA Technology-I
(Theory)**

Time: 3 Hours

Max. Marks: 75

Theory: 60

CA: 15

L-T-P: 3-0-0

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. Each question carries 12 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: CaCl₂, 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.Principles of Gene Manipulation and Genomics Kindle Edition,2013, by Sandy B. Primrose, Richard Twyman, Wiley-Blackwell
- 2.Recombinant DNA: Genes and Genomes A Short Course Third Edition| ©2007 James D. Watson; Richard M. Myers; Amy A. Caudy; Jan A. Witkowski
- 3.Gene Cloning and DNA Analysis: An Introduction, 2010, by T. A Brown, Blackwell Publishing.
- 4.rDNA technology:2nd edition, 2017, AD SHARMA. Himalaya publishing house
- 5.Analysis of Genes and Genomes, 2004, Richard J. Reece, Wiley-Blackwell

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5062
Course title: Animal Biotechnology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn about the different aseptic techniques used in Animal Tissue Culture (ATC).

CO2: Know about the different sources, types and eradication of contamination.

CO3: Study the different culture media and reagents used in ATC.

CO4: Study primary culture and establishment of cell line culture

Bachelor of Science (Bio-Technology) Semester-V

Session: 2025-26

Course Code: BBTL-5062

**Course title: Animal Biotechnology-I
(Theory)**

Time: 3 Hours

Max. Marks: 75

Theory: 60

CA: 15

L-T-P: 3-0-0

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. Each question carries 12 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 (2015) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. 7th Edition, John Wiley and Sons, New Delhi.

2. Animal Cell Culture: Essential Methods. Edited by John M. Davis. John Wiley & Sons, Ltd. UK. 2011
3. Cell Biology: A Laboratory Handbook. Volume 1-4, 3rd Edition. Edited by Julio E. Celis, Nigel Carter, Kai
4. Simons, J. Victor Small, Tony Hunter and David Shotton. Academic Press. USA, 2005
5. Butler, M. (2004). Animal Cell Culture and Technology, 2nd Ed., BIOS Scientific Publishers, Taylor & Francis group, London and New York.
6. Basic Cell Culture: A Practical Approach, 2nd ed. Edited by John Davis Oxford University Press, Oxford and New York. 2002

Bachelor of Science (Bio-Technology) Semester-V

Session: 2025-26

Course Code: BBTL-5063

**Course title: Plant Biotechnology-I
(Theory)**

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Explain totipotency, differentiation, and tissue culture lab organization and sterilization techniques.

CO2: Describe culture media components and functions of major plant growth regulators.

CO3: Demonstrate organogenesis, somatic embryogenesis, and micropropagation techniques.

CO4: Understand haploid/triploid production, embryo rescue, and somaclonal variation.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5063
Course title: Plant Biotechnology-I
(Theory)

Time: 3 Hours

Max. Marks: 75

Theory: 60

CA: 15

L-T-P: 3-0-0

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. Each question carries 12 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.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) Semester-V
Session: 2025-26
Course Code: BBTL-5064
Course title: Bioprocess Engineering-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the fundamental principles of chemical engineering and biochemical engineering.

CO2: Understand microbial growth kinetics

CO3: Understand the feedback system and know the effect of physico-chemical parameters on the product synthesis.

CO4: To study about sterilization of fermenter.

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Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5064
Course title: Bioprocess Engineering-I
(Theory)

Time: 3 Hours

Max. Marks: 75
Theory: 60
CA: 15

L-T-P: 3-0-0

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. Each question carries 12 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. and Hall, S.J. (2001), Principles of Fermentation Technology 2nd ed., Pergamon Press, Oxford.
2. Young, M.Y. (2000), Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.
3. Young, M.Y. (1996), Environmental Biotechnology, Principles & Applications, Kluwer
4. Academic Publications, New Delhi. 5. Bailary, J.E. and Ollis, D.F., (1986), Biochemical Engineering Fundamentals, McGraw Hills, N.Y.
5. S.J. Pirt (1985), Principles of microbes and cell cultivations. Blackwell Scientific Publication, London

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5065
Course title: Biochemical and Biophysical Techniques-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Gain fundamental knowledge about centrifugation.

CO2: Understand the different types of chromatography techniques.

CO3: Learn basic principles of spectroscopy

CO4: Understand the principles and instrumentation of NMR and ESR.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5065
Course title: Biochemical and Biophysical Techniques-I
(Theory)

Time: 3 Hours

Max. Marks: 50

Theory: 40

CA: 10

L-T-P: 2-0-0

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. Each question carries 08 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.

Unit III

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

Unit IV

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. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Sheehan, D. (2000). 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. Boye R (2006) Modern Experimental Biochemistry, Pearson Education, Asia, New
7. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Pub. House, New Delhi.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5066
Course title: Industrial Biotechnology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Describe microbial production of antibiotics, enzymes, solvents, biofertilizers, and biocontrol agents.

CO2: Explain the microbial production of fermented foods, organic acids, vitamins, amino acids, SCP, and mycotoxins.

CO3: Understand fuel biotechnology, transgenic crops, biogas production, and microbial biodegradation.

CO4: Explain biological nitrogen fixation, diazotroph characterization, and plant-microbe interactions in sustainable agriculture.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTL-5066
Course title: Industrial Biotechnology-II
(Theory)

Time: 3 Hours

Max. Marks: 50

Theory: 40

CA: 10

L-T-P: 2-0-0

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. Each question carries 08 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, Biotransformation, 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 and 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. Davis, B.D., Dulbecco, R., Eisen, H.N., & Ginsberg, H.S. (1990). *Microbiology* (4th Edition).
2. Tortora, G. J., Funke, B. R., & Case, C. L. (1994). *Microbiology an introduction*. 5th edition. Benjamin.
3. Stanier, R.Y. (1995). *General Microbiology*, MacMillan Press, London.
4. Pelczar, M.T (1995). *Microbiology*, Tata McGraw Hill Publication, New Delhi.
5. Schlegel. H.G., (1995). *General Microbiology* 7th Edition, Cambridge University Press.
6. Prescott and Dunn (1999). *Industrial Microbiology* 4th Edition, By S. K. Jain for CBS
7. Postgate. J. (2000). *Microbes & Man* 4th Edition, Cambridge University Press.
8. Tortora. G.J., Funke, B.R., (2001). *Microbiology: An Introduction*, Benjamin Cummings.
9. Stanbury, P.F., Whitaker, A. and Hall, S.J. (2001), *Principles of Fermentation Technology*
10. *Industrial Biotechnology: Approach to Clean Technology*. Jogdand, S.N. Himalaya Publishing House 2006.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5061 (P)
Course title: Lab in rDNA Technology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Culture *E. coli* and isolate high-quality genomic DNA.

CO2: Quantify and assess the purity of DNA using spectrophotometry

CO3: Perform agarose gel electrophoresis and restriction enzyme digestion.

CO4: Demonstrate the Southern blotting technique for DNA analysis.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5061
Course title: Lab in rDNA Technology-I
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. Growing of *E. coli* bacterial culture.
2. Isolation of genomic DNA from bacteria.
3. Spectrophotometric quantification of DNA and determination of purity.
4. Agarose Gel Electrophoresis.
5. 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 TA, Genomes, 3rd ed. Garland Science 2006

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5062
Course title: Lab in Animal Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Identify sources of contamination and apply decontamination measures effectively.

CO2: Prepare Hanks Balanced Salt Solution and Minimal Essential Growth Medium.

CO3: Separate serum from blood samples.

CO4: Isolate and culture macrophages from blood samples.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5062
Course title: Lab in Animal Biotechnology-I
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. Sterilization techniques: Theory and practical-Glassware sterilization, media sterilization, laboratory sterilization
2. Sources of contamination and decontamination measures.
3. Preparation of Hanks Balanced salt solution.
4. Preparation of Minimal Essential Growth medium.
5. Separation of Serum from blood.
6. Isolation of macrophages from blood for culturing.

Book Recommended:

1. Freshney, R.T. (2006), Culture of Animal Cells. 5 th ed., John Wiley and Sons, New Delhi.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2024-25
Course Code: BBTP-5063
Course title: Lab in Plant Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Get acquainted with functions and operations of PTC lab and various instruments used in plant tissue culture laboratory.

CO2: Learn sterilization process required in plant tissue culture.

CO3: Prepare media to be used in plant tissue culture.

CO4: Select, prepare, sterilize, and inoculate explants for culture initiation

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5063
Course title: Lab in Plant Biotechnology-I
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. 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.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5064
Course title: Lab in Bioprocess Engineering-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Study growth curve of microorganisms while growing them in different media under optimal conditions.

CO2: Determine the specific growth rate and generation time of a bacterium.

CO3: Study the effect of physico-chemical parameters on microbial growth

CO4: Perform assay of enzyme produced using fermentation.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5064
Course title: Lab in Bioprocess Engineering-I
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. 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).
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)

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5065
Course title: Lab in Biochemical and Biophysical Techniques-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Demonstrate the principle of sedimentation using swing-out and angle rotors.

CO2: Separate biomolecules using paper and thin layer chromatography.

CO3: Separate proteins using ion-exchange chromatography

CO4: Apply affinity chromatography for purification of specific proteins.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5065
Course title: Lab in Biochemical and Biophysical Techniques-I
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. 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.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5066
Course title: Lab in Industrial Biotechnology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

- CO1:** Screen cellulose-producing microorganisms from environmental samples.
- CO2:** Evaluate the additive and synergistic effects of antibiotics on microbial growth.
- CO3:** Determine the minimum inhibitory concentration (MIC) of antibiotics.
- CO4:** Assess microbial quality of milk and identify microbes from spoiled food samples.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5066
Course title: Lab in Industrial Biotechnology-II
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. Alcoholic and mixed acid fermentation.
2. Demonstration of wine production using grape juice.
3. Determination of nitrate reduction of bacteria.
4. Additive and Synergistic effect of two antibiotics on the above microorganism.
5. Minimum inhibitory concentration of a antibiotics for the above microorganism.
6. Plating the milk samples for microbial counting.
7. MBRT Test for determination of milk quality.
8. Isolation and identification of microbes from spoiled food sample.

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-VI

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6061
Course title: rDNA Technology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Explain different cloning and expression vectors used in molecular biology.

CO2: Describe genomic and cDNA cloning techniques along with linker and adapter strategies.

CO3: Understand the principles and applications of PCR and microarray technologies.

CO4: Analyze DNA sequencing methods and apply site-directed mutagenesis techniques.

Bachelor of Science (Bio-Technology) Semester-VI

Session: 2025-26

Course Code: BBTL-6061

**Course title: rDNA Technology-II
(Theory)**

Time: 3 Hours

Max. Marks: 75

Theory: 60

CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setter

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. Each question carries 12 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.

UNIT-IV

DNA Sequencing: Sanger-Coulson method (chain terminating nucleotides), Maxam Gilbert method (chemical degradation of DNA), 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.Principles of Gene Manipulation and Genomics Kindle Edition,2013, by Sandy B. Primrose, Richard Twyman, Wiley-Blackwell
- 2.Recombinant DNA: Genes and Genomes A Short Course Third Edition| ©2007 James D. Watson; Richard M. Myers; Amy A. Caudy; Jan A. Witkowski
- 3.Gene Cloning and DNA Analysis: An Introduction, 2010, by T. A Brown, Blackwell Publishing.
- 4.rDNA technology:2nd edition, 2017, AD SHARMA. Himalaya publishing house
- 5.Analysis of Genes and Genomes, 2004, Richard J. Reece, Wiley-Blackwell

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6062
Course title: Animal Biotechnology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Identify commonly used animal cell lines, their characteristics, and organ culture techniques.

CO2: Describe various cloning vectors, transfection methods, and expression systems in animal cells.

CO3: Explain applications of cell culture including monoclonal antibody production, bioreactors, and stem cell characterization.

CO4: Understand genetic engineering approaches in animal cells for producing therapeutic proteins, vaccines, and transgenic animals.

Bachelor of Science (Bio-Technology) Semester-VI

Session: 2025-26

Course Code: BBTL-6062

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

Time: 3 Hours

Max. Marks: 75

Theory: 60

CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setter

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. Each question carries 12 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 (2015) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. 7th Edition, John Wiley and Sons, New Delhi.

2. Animal Cell Culture: Essential Methods. Edited by John M. Davis. John Wiley & Sons, Ltd. UK. 2011
3. Cell Biology: A Laboratory Handbook. Volume 1-4, 3rd Edition. Edited by Julio E. Celis. Nigel Carter, Kai 4. Simons, J. Victor Small, Tony Hunter and David Shotton. Academic Press. USA, 2005
4. Butler, M. (2004). Animal Cell Culture and Technology, 2nd Ed., BIOS Scientific Publishers, Taylor & Francis group, London and New York.
5. Basic Cell Culture: A Practical Approach, 2nd ed. Edited by John Davis Oxford University Press, Oxford and New York. 2002

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6063
Course title: Plant Biotechnology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform protoplast isolation, fusion, and plant cell culture for metabolite production and germplasm conservation.

CO2: Understand plant gene organization and Agrobacterium-mediated genetic transformation.

CO3: Describe direct gene transfer methods and transgene screening in plants.

CO4: Apply transgenic techniques to improve resistance, nutrition, and produce valuable biomolecules.

Bachelor of Science (Bio-Technology) Semester-VI

Session: 2025-26

Course Code: BBTL-6063

**Course title: Plant Biotechnology-II
(Theory)**

Time: 3 Hours

Max. Marks: 75

Theory: 60

CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setter

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. Each question carries 12 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) Semester-VI
Session: 2025-26
Course Code: BBTL-6064
Course title: Bioprocess Engineering-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn about the design of a fermenter and how to use it.

CO2: Study about all the parameters to be considered while operating a fermenter.

CO3: Study about different techniques of downstream processing.

CO4: Learn about effluent treatment and fermentation economics.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6064
Course title: Bioprocess Engineering-II
(Theory)

Time: 3 Hours

Max. Marks: 75
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setter

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. Each question carries 12 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. and Hall, S.J. (2001), Principles of Fermentation Technology 2nd ed., Pergamon Press, Oxford.
2. Young, M.Y. (2000), Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.
3. Young, M.Y. (1996), Environmental Biotechnology, Principles & Applications, Kluwer
4. Academic Publications, New Delhi. 5. Bailly, J.E. and Ollis, D.F., (1986), Biochemical Engineering Fundamentals, McGraw Hills, N.Y.
5. S.J. Pirt (1985), Principles of microbes and cell cultivations. Blackwell Scientific Publication, London.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6066
Course title: Biochemical and Biophysical Techniques-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Explain principles and applications of different electrophoresis methods for biomolecule separation.

CO2: Describe advanced electrophoresis techniques.

CO3: Understand mass spectrometry techniques and their biological applications; learn basics of fluorescence spectroscopy.

CO4: Learn radioisotopic techniques, instruments, applications, and safety measures in biological studies.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6066
Course title: Biochemical and Biophysical Techniques-II
(Theory)

Time: 3 Hours

Max. Marks: 50

Theory: 40

CA: 10

L-T-P: 2-0-0

Instructions for the Paper Setter

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. Each question carries 08 marks.

UNIT-I

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-II

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 III

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

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. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
- 2.Sheehan, D. (2000). 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. Boye R (2006) Modern Experimental Biochemistry, Pearson Education, Asia, New
7. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Pub. House, New Delhi.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6061
Course title: Lab in rDNA Technology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate and analyze plasmid DNA.

CO2: Perform restriction digestion using different enzymes.

CO3: Prepare competent cells and carry out transformation using the CaCl_2 method.

CO4: Perform Polymerase Chain Reaction (PCR).

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6061
Course title: Lab in rDNA Technology-II
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. Isolation of plasmid DNA
2. Digestion of plasmid with three different restriction enzymes.
3. To perform ligation reaction
4. Preparation of competent cells
5. Transformation of competent cells by CaCl_2 method.
6. Confirmation of the transformants for the presence of plasmid.
7. To perform PCR

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 TA, Genomes, 3rd ed. Garland Science 2006

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6062
Course title: Lab in Animal Biotechnology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate DNA and RNA from blood samples.

CO2: Quantify isolated DNA using spectrophotometry.

CO3: Resolve DNA using agarose gel electrophoresis.

CO4: Purify IgG antibodies and maintain cell lines while determining doubling time.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6062
Course title: Lab in Animal Biotechnology-II
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. 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.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6063
Course title: Lab in Plant Biotechnology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform different steps of micropropagation.

CO2: Demonstrate the role of growth hormones in plant tissue culture.

CO3: Induce callus and regenerate shoots or embryos from explants.

CO4: Raise cell suspension cultures and perform anther, ovary culture, and embryo rescue.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6063
Course title: Lab in Plant Biotechnology-II
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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) Semester-VI
Session: 2025-26
Course Code: BBTP-6064
Course title: Lab in Bioprocess Engineering-II (Industrial Training)
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Undergo two-week training in fermentation technology in industry/institute and learn practical aspects of fermentation technology

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6064
Course title: Lab in Bioprocess Engineering-II (Industrial Training)
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Note:

Students will go for at least two-week training in industry/institute and the students will be required to submit written report of their training which will be evaluated by the teacher who has taught theory course.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6066
Course title: Biochemical and Biophysical Techniques-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Analyze DNA samples qualitatively and quantitatively.

CO2: Prepare standard curves for proteins and DNA.

CO3: Cast vertical and horizontal gels for electrophoresis.

CO4: Separate biomolecules using gel electrophoresis techniques.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6066
Course title: Biochemical and Biophysical Techniques-II
(Practical)

Time: 3 Hrs.

Max. marks: 25

Practical Marks: 20

CA: 05

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. Qualitative and quantitative analysis of DNA sample
2. Preparation of standard curve of protein
3. Preparation of standard curve of DNA.
3. Casting of Native-PAGE gel and separation of bio-molecules by electrophoresis.
4. To perform IEF.

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (1995). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Riley, T. and Tomilson, C. (1987). Principles of Electroanalytical Methods. John Wiley and Sons Ltd., Chichester, England.
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ANNEXURE D

FACULTY OF LIFE SCIENCES

SYLLABUS

of

**Bachelor of Science (Honours) (Medical Laboratory Technology)
(Semester: III-IV)**

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26



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

Bachelor of Science (Honours) (Medical Laboratory Technology) (Semester -III)											
Course Code	Course Title	Cours e Type	Total Credits (L-T- P)	Credit Hours			Total Mark s	Marks			Exam Time in Hrs
				L	T	P		L	P	CA	
BMLL-3481	Haematology- II	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-3481	Haematology- II Lab	DSC	0-0-2	-	-	4	50	-	35	15	3
BMLL- 3482	Pathology- I	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-3482	Pathology-I Lab	DSC	0-0-2	-	-	4	50	-	35	15	3
BMLL-3483	Clinical Biochemistry-I	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-3483	Clinical Biochemistry-I Lab	DSC	0-0-2		-	4	50	-	35	15	3
BMLL-3064	Introduction to Bacteriology and Virology	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-3064	Introduction to Bacteriology and Virology Lab	DSC	0-0-1	-	-	2	50	-	35	15	3
BMLL-3065	Basics of Microbiology-I	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-3065	Basics of Microbiology-I Lab	DSC	0-0-1	-	-	2	50	-	35	15	3
VACG-3531	*Gender Sensitization	VAC	1-0-1	1	-	2	50	35	-	15	1
	Total Credits		25	Total marks			800				

Bachelor of Science (Honours) (Medical Laboratory Technology) (Semester -IV)											
Course Code	Course Title	Course Type	Total Credits (L-T-P)	Credit Hours			Total Marks	Marks			Exam Time in Hrs
				L	T	P		L	P	CA	
BMLL-4481	Haematology-III	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-4481	Haematology-III Lab	DSC	0-0-2	-	-	4	50	-	35	15	3
BMLL-4482	Pathology-II	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-4482	Pathology-II Lab	DSC	0-0-2	-	-	4	50	-	35	15	3
BMLL-4483	Clinical Biochemistry-II	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-4483	Clinical Biochemistry-II Lab	DSC	0-0-2	-	-	4	50	-	35	15	3
BMLL-4064	Basics of Microbiology-II	DSC	3-0-0	3	-	-	100	70	-	30	3
BMLP-4064	Basics of Microbiology-II Lab	DSC	0-0-1	-	-	2	50	-	35	15	3
BMLL-4485	Immunology-I	MDC-I	3-0-0	3	-	-	100	70	-	30	3
BMLP-4485	Immunology-I Lab	MDC-I	0-0-1	-	-	2	50	-	35	15	3
VACE-4221	*Environmental Studies (Compulsory)	VAC	1-0-1	1	-	2	50	25	10	15	3
Total Credits			25	Total marks			800				

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-III
Session: 2025-26
Course Title: Introduction to Bacteriology and Virology
Course Code: BMLL-3064
(Theory)

COURSE OUTCOMES

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

CO 1: learn the history of microbiology and fundamental microbiology techniques

CO 2: learn the classification, morphology, pathogenicity, and lab diagnosis of clinically important bacteria.

CO 3: learn the structure, replication, and detection methods of viruses.

CO 4: learn the growth, culture, effects, and diagnosis of viral infection.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-III
Session: 2025-26
Course Title: Introduction to Bacteriology and Virology
Course Code: BMLL-3064
(Theory)

Time: 3 Hrs.

Max. Marks: 100

L-T-P: 3-0-0

Theory: 70

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. Each question carries 14 marks

Section-A

Brief history of microbiology with special reference to the contributions of Louis Pasteur, Robert Koch and others. Morphology and growth requirements of bacteria. Sterilization and disinfection procedures. Stains – Gram's Stain, ZN Stain and special stain. Cultivation methods, isolation and identification of bacteria. Antibiotic susceptibility testing and antibiotic resistance mechanisms in bacteria.

Section-B

Study (Classification, morphology, cultural characteristics, biochemical reaction, pathogenesis/disease caused and lab diagnosis) of clinically important bacteria- Staphylococcus, Streptococcus, Neisseria, Corynebacterium, Mycobacterium, Clostridium, *E. coli*, Klebsiella, Salmonella, Proteus, Pseudomonas, Vibrio and Spirochaetes (Treponema, Borrelia and Leptospira), Mycoplasma, *Helicobacter pylori*

Section-C

Brief history of virology. Virus: general characteristics, Morphology: envelope, capsid and nucleic acid. Bacteriophages. Lytic and lysogenic cycle. Detection of virus: Complement fixation test, haemagglutination, serological and molecular based methods. Electron microscopic techniques for visualization of virus

Section-D

One step growth curve for virus. Culture of animal virus. Cytopathogenic effects of virus infection. Symptoms, transmission, pathogenesis, detection and treatment of viral diseases: Influenza, Dengue, Hepatitis and AIDS.

Recommended Books:

1. Pelczar, M.J. Chan, E.C.S. and Krieg, N.R. 1986, Microbiology, 5th Ed. McGraw Hill.
2. Woolverten C. J. and Sherwood L. 1990. Prescott's Microbiology. 10th Ed. WCB Publishers.
3. Cann, Allan J. 1997. Principles of Molecular Virology, Academic Press London.
4. E.K. Wagner and M.J. Hewlet. 2004. Basic virology (2nd Ed) Blackwell publisher.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-III
Session: 2025-26
Course Title: Introduction to Bacteriology and Virology Lab
Course Code: BMLP-3064
(Practical)

COURSE OUTCOMES

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

CO 1: learn the preparation of culture media and apply various cultural and staining techniques for bacterial identification.

CO 2: learn and perform bacterial isolation, enumeration, and cultivation using streaking, spreading, pour plating, and serial dilution methods

CO 3: learn and conduct biochemical tests for bacterial characterization and perform antibiotic susceptibility testing using the Kirby-Bauer method

CO 4: learn the estimation of blood sugar and perform immunological assays like the haemagglutination test.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-III
Session: 2025-26
Course Title: Introduction to Bacteriology and Virology Lab
Course Code: BMLP-3064
(Practical)

Credits: 0-0-1

Total marks: 50

Practical Marks: 35

Time: 3 Hrs.

CA:15

Experiments:

1. Composition and preparation of culture media and cultural characterization of bacteria
2. Isolation and enumeration of bacteria using serial dilution method
3. To perform various biochemical tests: IMViC test.
4. Antibiotic susceptibility test by Kirby Bauer Method
5. Estimation of blood sugar.
6. Haemagglutination assay.
7. Quantification of virus in infected plant leaves by protein estimation
8. Detection of purified/semi purified virus preparation by UV spectrophotometer

Recommended Books:

1. Cappuccino J and Sherman N. Microbiology: A laboratory manual. 10thEd. Pearson Learning.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology)
Session: 2025-26
Semester-III
Course Title: Basics of Microbiology-I
Course Code: BMLL-3065
(Theory)

COURSE OUTCOMES

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

CO 1: learn the historical developments in microbiology, classification of microorganisms, and concepts like biogenesis, fermentation, and germ theory of disease

CO 2: learn basic microbiological techniques and media preparation.

CO3: to learn methods for obtaining and maintaining pure cultures, identifying cultural characteristics, and preserving microbial strains.

CO 4: learn the nutritional and physical conditions required for microbial growth and the factors influencing it

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology)
Session: 2025-26
Semester-III
Course Title: Basics of Microbiology-I
Course Code: BMLL-3065
(Theory)

Time: 3 Hrs.

Max. Marks: 100

L-T-P: 3-0-0

Theory: 70

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. Each question carries 14 marks

Section A

Historical aspects and discovery of microorganisms in the living world (Haeckels kingdom Protista, Prokaryotes and Eukaryotes, Whittaker's five kingdom concept, Koch's postulates) groups of microorganisms, distribution in nature, spontaneous generation verses biogenesis, fermentation, germ theory of disease. Identification of microorganisms

Section B

Microscopy and staining, microbiological techniques, pour plating, spreading, streaking serial dilution, methods of sterilization, media preparation, types of media (synthetic, natural, enrichment, selective)

Section C

Pure cultures and cultural characteristics: Mixed culture, selective methods, natural selection of microorganisms, maintenance and preservation of cultures, culture collection and cataloging of pure cultures, colony characteristics and characteristics of broth cultures.

Section D

Nutritional requirements for growing microorganisms: Physical conditions required for growth: Temperature, gaseous, pH, miscellaneous, factors affecting growth.

Books Recommended:

1. Stanier, R.Y. Adelberg, A. and Ingraham, J. L.(1984), General Microbiology, IV edn. Mac Millan Press.
2. Pelczar, M.J.Chan, E.C.S. and Krieg, N.R (1986), Microbiology, V Ed. McGraw Hill.
3. Prescott. L.M. Harley J.P.and L.Kreig D.A (1990). Microbiology, WCB Publishers.
4. Rosenberg, E & Cohen I. R. (1983). Microbial Biology. H.S. International Editions.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology)
Session: 2025-26
Semester-III
Course Title: Basics of Microbiology-I Lab
Course Code: BMLP-3065
(Practical)

COURSE OUTCOMES

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

CO 1: learn the use and handling of basic laboratory apparatuses and compound microscope in microbiology.

CO 2: learn various sterilization techniques and preparation of culture media and agar slants/deeps.

CO 3: learn and perform serial dilution techniques for enumeration of microorganisms.

CO 4: learn and apply cultural techniques like pour plating, spreading, and streaking for microbial cultivation.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology)
Session: 2025-26
Semester-III
Course Title: Basics of Microbiology-I Lab
Course Code: BMLP-3065
(Practical)

Credits: 0-0-1

Total marks: 50

Practical Marks: 35

Time: 3 Hrs.

CA:15

Experiments:

1. To study different lab apparatuses used in microbiology.
2. To study compound microscope.
3. To study various techniques of sterilization.
4. To prepare media and its sterilization.
5. To prepare agar slants/deeps.
6. Serial dilution for enumeration of microorganisms.
7. To study various cultural techniques like pour plating, spreading and streaking.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Pearson Education India.
2. Dubey R.C. and Maheshwari (2012). Practical Microbiology 5th edition: S. Chand and company ltd. New Delhi.
3. Leoeffee, M.J. and Pierce, B.E. (2015). Microbiology: Laboratory Theory and Application, 3rd Edition, Morton Pub. Co.
4. Sastry, A.S. and Bhat, S. (2018). Essentials of Practical microbiology. Jaypee Brothers Medical Publishers.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-IV
Session: 2025-26
Course Title: Basics of Microbiology-II
Course Code: BMLL-4064
(Theory)

COURSE OUTCOMES

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

CO 1: learn the morphology, fine structure, and growth patterns of bacteria, fungi, protozoa, and viruses

CO 2: learn the physical methods used to control microorganisms and factors affecting microbial death.

CO 3: learn the chemical control of microbes, including types, properties, and evaluation of antimicrobial agents.

CO 4: learn the properties and action of antibiotics, mechanisms of drug resistance, antibiotic sensitivity testing, and normal microbial flora of the human body

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-IV
Session: 2025-26
Course Title: Basics of Microbiology-II
Course Code: BMLL-4064
(Theory)

Time: 3 Hrs.

Max. Marks: 100

L-T-P: 3-0-0

Theory: 70

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. Each question carries 14 marks

Section A

General account of Bacteria: Morphology and fine structure, Mode of cell division, growth curve of bacteria mathematical expression of growth, quantitative measurement of bacterial growth, Structure of fungi, protozoa, viruses.

Section B

Fundamentals of control of microorganisms, the rate of death of bacteria, conditions influencing antimicrobial action, Control of microbes by physical agents: temperature, desiccation, osmotic pressure, radiation, filtration

Section C

Control of microbes by chemical agents: characteristics of ideal chemical agents, major group of antimicrobial agents and mode of action, evaluation of antimicrobial agents.

Section D

Antibiotics: properties and mode of action. Drug resistance and its significance. Antibiotic Sensitivity test. Microbial flora of healthy human host

Books Recommended:

1. Stanier, R.Y. Adelberg, E.A. and Ingraham, J.L. (1984), General Microbiology, IV edn. Mac Millan Press.
2. Pelczar, M.J. Chan, E.C.S and Krieg, N.R. (1986), Microbiology, VEd. McGraw Hill.
3. Prescott. L.M. Harley J.P. and L. Kreig D.A.(1990).Microbiology, WCB Publishers.
4. Rosenberg, E & Cohen I. R.(1983).Microbial Biology. H.S. International Editions.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-IV
Session: 2025-26
Course Title: Basics of Microbiology-II Lab
Course Code: BMLP-4064
(Practical)

COURSE OUTCOMES

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

CO 1: learn and perform staining techniques to observe the morphology and cell structure of microorganisms

CO 2: learn to count microorganisms using a hemocytometer and measure bacterial size using a micrometer

CO 3: learn and perform key biochemical tests for microbial identification and characterization.

CO 4: develop practical skills in handling microbial samples and interpreting laboratory results.

Kanya Maha Vidyalaya, Jalandhar (Autonomous)
Bachelor of Science (Honours) (Medical Laboratory Technology) Semester-IV
Session: 2025-26
Course Title: Basics of Microbiology-II Lab
Course Code: BMLP-4064
(Practical)

Credits: 0-0-1

Total marks: 50

Practical Marks: 35

Time: 3 Hrs.

CA:15

1. To study the morphology cell structure of microorganisms through staining procedures.
 - a. Simple staining
 - b. Gram staining
 - c. Negative staining
2. To count the number of microorganisms by hemocytometer. Measure size of bacteria using micrometer.
3. To perform various biochemical tests: Acid gas production, nitrate reduction test, gelatin, catalase production, oxidase production.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Pearson Education India.
2. Dubey R.C. and Maheshwari (2012). Practical Microbiology 5th edition: S. Chand and company ltd. New Delhi.
3. Leooffee, M.J. and Pierce, B.E. (2015). Microbiology: Laboratory Theory and Application, 3rd Edition, Morton Pub. Co.
4. Sastry, A.S. and Bhat, S. (2018). Essentials of Practical microbiology. Jaypee Brothers Medical Publishers.

ANNEXURE F

Department of Bio-Technology
Session: 2025-26
Teaching Methodologies

Teaching Methodologies adopted in the department:

- ICT based Teaching
- Hands-on-practice in labs.
- Summer Training at various research Institutes like CSIR-IHBT, Palampur, NIT, Jalandhar, CSIR-IGIB, Delhi, et.
- Industrial Trainings at different industries like Verka Milk Plant, Cremica etc.
- Extension Lectures and Experimental Workshops by renowned experts etc.
- Different competitions at Department Level like Power point competition, poster making competition, quiz, slogan writing competition, Fermentology fiesta, idea presentation, etc.
- Student mentoring to resolve personal problems of students.
- Remedial classes for weak and advanced learners.
- Online assignments to students to expose students to recent research.
- Online Teaching through LMS, Learning Management System of our college.
- Extended practicals and small research projects to students.
- Expert Talks, Workshops are organized to give exposure to recent research in sciences.
- Alumni talks and career counseling sessions to make students aware about the scope and career opportunities in biotechnology.

ANNEXURE G

Research inputs and plans of the Department of Bio-Technology (Session 2025–26)

The Department of Biotechnology is committed to fostering a research-driven academic environment that addresses contemporary scientific challenges and promotes innovation. For the academic session 2025–26, the department has formulated the following research inputs and plans:

- Encourage faculty and students to publish their research findings in peer-reviewed national and international journals.
- Establish research clusters among faculty members to promote interdisciplinary collaboration.
- Promote mini research projects for final-year undergraduate students to enhance their analytical and problem-solving skills.
- Motivate students to participate in national-level innovation, research, and startup competitions.
- Organize internships, guest lectures, and seminars in collaboration with industry experts to bridge the gap between academia and industry.
- Facilitate industry-sponsored student research projects and consultancy services to promote applied research.
- Encourage student participation in incubation programs and provide mentorship support for those with entrepreneurial aspirations.
- Conduct hands-on training workshops to strengthen practical skills.
- Guide and prepare students for national-level competitive examinations such as GATE, GAT-B, IIT JAM, and other higher education entrance tests.

ANNEXURE H

KANYA MAHA VIDYALAYA, JALANDHAR (AUTONOMOUS)
COURSE OUTCOMES
SESSION: 2023-24

Bachelor of Science (Bio-Technology) Semester I

Score attainment of Course Outcome across Bachelor of Science (Bio-Technology) Semester I

Course title	Course Code	CO1	CO2	CO3	CO4
Punjabi compulsory, Basic Punjabi and Punjab History and Culture	BBTL-1421, BBTL-1031, BBTL-1431	3	4	3.5	4
Communication skills in English	BBTL-1102	2.5	4	2.5	3
Cell Biology	BBTM-1483	3	3	3	3
Botany-I	BBTM-1074	2	2	3	1
Biochemistry-I	BBTM-1085	3	2.5	2	3
Chemistry-I	BBTM-1087	2	3.5	2.5	3
General Microbiology-I	BBTM-1346	4	4	4	3.5

Student Percentage attaining CO between different range levels depending on weightage for Bachelor of Science (Bio-Technology) Semester I

Number of students obtaining marks for each CO between	Average	
75% to 100%	9	highest
60% to 75%	5	high
50% to 60%	1	medium
40% to 50%	0	lower
below 40%	1	low

B.Sc. Bio-Technology Semester II

Score attainment of Course Outcome across Bachelor of Science (Bio-Technology) Semester II

Course title	Course Code	CO1	CO2	CO3	CO4
Punjabi compulsory, Basic Punjabi and Punjab History and Culture	BBTL-2421, BBTL-2031, BBTL-2431	4	3.5	3.5	3
Communication skills in English	BBTM-2102	1	1	1	3
Biomathematics and Biostatistics	BBTM-2333	0	2	1	1.5
Zoology -I	BBTL-2484	2.5	2.5	2.5	1.5
Biochemistry-II	BBTM-2086	3.5	3	3	4
Genetics	BBTL-2065	3	3	3	3
General Microbiology-II	BBTM-2347	4	4	2.5	3

Student Percentage attaining CO between different range levels depending on weightage for Bachelor of Science (Bio-Technology) Semester II

Number of students obtaining marks for each CO between	Average	
75% to 100%	4	highest
60% to 75%	7	high
50% to 60%	2	medium
40% to 50%	2	lower
below 40%	1	low

B.Sc. Bio-Technology Semester III

Score attainment of Course Outcome across Bachelor of Science (Bio-Technology) Semester III

Course title	Course Code	CO1	CO2	CO3	CO4
Fundamentals of Biotechnology	BBTM-3061	4	4	4	4
Immunology-I	BBTM-3062	3	2.5	4	2.5
Chemistry-II	BBTM-3083	2	2	2	2
Botany-II	BBTM-3074	4	3	3.5	4
Biochemistry-III	BBTM-3085	4	4	4	4
Molecular biology	BBTM-3066	3	3	3	1.5

Student Percentage attaining CO between different range levels depending on weightage for Bachelor of Science (Bio-Technology) Semester III

Number of students obtaining marks for each CO between	Average	
75% to 100%	4	highest
60% to 75%	3	high
50% to 60%	3	medium
40% to 50%	1	lower
below 40%	0	low

BSc Bio-Technology Semester IV

Score attainment of Course Outcome across Bachelor of Science (Bio-Technology) Semester IV

Course title	Course Code	CO1	CO2	CO3	CO4
Industrial Biotechnology-I	BBTM-4061	3.5	3	3	3
Immunology-II	BBTM-4062	4	3.5	2.5	2
Skill development in Biotechnology	BBTM-4064	3.5	3	3	4
Fundamentals of Bioinformatics	BBTM-4065	3	3.5	4	3
Biochemistry-IV	BBTM-4083	4	4	4	4
Zoology-II	BBTM-4486	3.5	3.5	4	4

Student Percentage attaining CO between different range levels depending on weightage for Bachelor of Science (Bio-Technology) Semester IV

Number of students obtaining marks for each CO between	Average	
75% to 100%	7	highest
60% to 75%	2	high
50% to 60%	0	medium
40% to 50%	0	lower
below 40%	1	low

B.Sc. Bio-Technology Semester V

Score attainment of Course Outcome across Bachelor of Science (Bio-Technology) Semester V

Course title	Course Code	CO1	CO2	CO3	CO4
Industrial biotechnology-II	BBTM-5066	3.5	3	4	3.5
Bioprocess engineering-I	BBTM-5064	4	4	4	3.5
Plant Biotechnology-I	BBTM-5062	4	4	3	4
Biochemical and biophysical techniques-I	BBTM-5065	4	4	2.5	4
rDNA Technology-I	BBTM-5061	3.5	4	4	4
Animal Biotechnology-I	BBTM-5063	3	3	4	3.5

Student Percentage attaining CO between different range levels depending on weightage for Bachelor of Science (Bio-Technology) Semester V

Number of students obtaining marks for each CO between	Average	
75% to 100%	12	highest
60% to 75%	0	high
50% to 60%	0	medium
40% to 50%	0	lower
below 40%	0	low

BSc Bio-Technology Semester VI

Score attainment of Course Outcome across Bachelor of Science (Bio-Technology) Semester VI

Course title	Course Code	CO1	CO2	CO3	CO4
Chemistry-III	BBTM-6085	4	4	3.5	4
Bioprocess engineering-II with training	BBTM-6064	3.5	3.5	4	3.5
Plant Biotechnology-II	BBTM-6063	4	4	3	4
Biochemical and biophysical techniques-II	BBTM-6066	4	2.5	3	4
rDNA Technology-II	BBTM-6061	2.5	3	3.5	3.5
Animal Biotechnology-II	BBTM-6062	3	3	3.5	2.5

Student Percentage attaining CO between different range levels depending on weightage for Bachelor of Science (Bio-Technology) Semester VI

Number of students obtaining marks for each CO between	Average	
75% to 100%	9	highest
60% to 75%	2	high
50% to 60%	1	medium
40% to 50%	0	lower
below 40%	0	low

KANYA MAHA VIDYALAYA, JALANDHAR (AUTONOMOUS)**PROGRAMME SPECIFIC OUTCOMES****SESSION: 2023-24****BACHELOR OF SCIENCE (BIO-TECHNOLOGY) SEMESTER-I**

Course title (Course code)	PSO attainment level						
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Basic Punjabi (BBTL-1031)	0	0	0	0	4	0	4
Punjabi (Compulsory) (BBTL-1421)	0	0	0	0	4	0	4
Punjab History and Culture (BBTL-1431)	1	0	4	0	2	0	0
Communication Skills in English (BBTL-1102)	0	0	2	0	1	0	3
Cell Biology (BBTL-1483)	2	0	1	0	2	0	1
Botany-I (BBTL-1074)	2	1	0	0	1	1	0
Biochemistry-I (BBTL-1085)	3	1	0	0	0	1	1
General Microbiology-I (BBTL-1346)	4	1	0	1	0	0	1
Chemistry-I (BBTL-1087)	1	0	0	0	3	3	0

BACHELOR OF SCIENCE (BIO-TECHNOLOGY) SEMESTER-II

Course title (Course code)	PSO attainment level						
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Basic Punjabi (BBTL-2031)	0	0	2	0	2	0	4
Punjabi (Compulsory) (BBTL-2421)	0	0	1	0	2	0	4
Punjab History and Culture (BBTL-2431)	0	4	1	0	2	0	0
Communication Skills in English (BBTM-2102)	0	0	2	0	0	0	2
Biomathematics and Biostatistics (BBTL-2333)	0	1	0	1	0	0	0
Zoology-I (BBTL-2484)	1	1	0	1	0	0	2
Genetics (BBTL-2065)	2	2	0	0	1	1	0
Biochemistry-II (BBTL-2086)	3	1	0	0	0	1	2
General Microbiology-II (BBTL-2347)	1	1	1	1	0	1	1

BACHELOR OF SCIENCE (BIO-TECHNOLOGY) SEMESTER-III

Course title (Course code)	PSO attainment level						
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Fundamentals of Biotechnology (BBTM-3061)	2	1	1	0	1	1	1
Immunology-I (BBTM-3062)	1	1	1	0	0	1	2
Chemistry-II (BBTM-3083)	1	0	0	0	1	2	0
Botany-II (BBTM-3074)	4	2	0	0	0	1	1
Biochemistry-III (BBTM-3085)	2	2	0	0	0	0	2
Molecular Biology (BBTM-3066)	3	1	0	0	0	1	0

BACHELOR OF SCIENCE (BIO-TECHNOLOGY) SEMESTER-IV

Course title (Course code)	PSO attainment level						
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Industrial Biotechnology-I (BBTM-4061)	1	1	1	1	1	1	1
Immunology-II (BBTM-4062)	1	1	1	1	1	1	1
Skill Development in Biotechnology (BBTM-4064)	2	1	0	0	2	1	1
Fundamentals of Bioinformatics (BBTM-4065)	1	1	0	1	0	2	1
Biochemistry-IV (BBTM-4083)	2	0	0	0	0	2	2
Zoology-II (BBTM-4486)	0	0	0	0	0	0	4

BACHELOR OF SCIENCE (BIO-TECHNOLOGY) SEMESTER-V

Course title (Course code)	PSO attainment level						
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
rDNA Technology-I (BBTM-5061)	2	2	1	1	0	1	0
Plant Biotechnology-I (BBTM-5062)	2	1	0	0	0	4	0
Animal Biotechnology-I (BBTM-5063)	2	1	1	1	1	1	1
Bioprocess Engineering-I (BBTM-5064)	2	2	0	1	0	2	0
Biochemical and Biophysical Techniques-I (BBTM-5065)	2	1	0	1	0	2	0
Industrial Biotechnology-II (BBTM-5066)	2	1	0	2	1	1	0

BACHELOR OF SCIENCE (BIO-TECHNOLOGY) SEMESTER-VI

Course title (Course code)	PSO attainment level						
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
rDNA Technology-II (BBTM-6061)	1	1	0	1	0	1	1
Plant Biotechnology-II (BBTM-6062)	2	0	1	1	0	2	1
Animal Biotechnology-II (BBTM-6063)	1	1	1	1	0	1	1
Bioprocess Engineering-II with training (BBTM-6064)	2	2	1	1	0	1	0
Chemistry-III (BBTM-6085)	1	1	0	0	1	3	0
Biochemical and Biophysical Techniques-II (BBTM-6066)	1	2	0	2	0	1	1

BACHELOR OF SCIENCE (BIO-TECHNOLOGY)

PSO Attainment Level	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7
Semester-I	1	0	1	0	2	0	1
Semester-II	1	1	1	0	1	0	1
Semester-III	2	1	0	0	0	1	1
Semester-IV	1	1	0	0	1	1	1
Semester-V	2	1	0	1	0	2	0
Semester-VI	1	1	0	1	0	1	1

