

**FACULTY OF LIFE SCIENCES**

**SYLLABUS**

**Of**

**Bachelor of Science Bio-Technology (Semester: III-VI)**

**(Under Continuous Evaluation System)**

**Session: 2023-24**



**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 Biotechnology.

**PSO2:** design, perform experiments, analyze and interpret data for investigating complex problems in the field of biotechnology.

**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 & society.

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

**PSO6:** contribute to the field of biotechnology and allied industries designing, developing and providing solutions for product/processes/technology development.

**PSO7:** able to justify societal, health, safety and legal issues and understand his 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: 2023-24**

<b>Bachelor of Science (Bio-Technology) Semester-III</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-3061	Fundamentals of Biotechnology	C	60	30	18	12	3+3
BBTM-3062	Immunology-I	C	60	30	18	12	3+3
BBTM-3083	Chemistry-II	C	60	30	18	12	3+3
BBTM-3074	Botany-II	C	60	30	18	12	3+3
BBTM-3085	Biochemistry-III	C	60	30	18	12	3+3
BBTM-3066	Molecular Biology	C	60	30	18	12	3+3
AECE-3221	*Environmental Studies (Compulsory Paper)	AC	100	60	20	20	3
SECP-3512	*Personality Development	AC	25	20	-	5	-
<b>Total</b>			<b>360</b>				

\*Marks of these papers will not be added in total marks and only grades will be provided.

**C-Compulsory**

**AC- Audit Course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**  
**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**  
**Bachelor of Science (Bio-Technology)**

**Session: 2023-24**

<b>Bachelor of Science (Bio-Technology) Semester-IV</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-4061	Industrial Biotechnology-I	C	60	30	18	12	3+3
BBTM-4062	Immunology-II	C	60	30	18	12	3+3
BBTM-4083	Biochemistry-IV	C	60	30	18	12	3+3
BBTM-4064	Skill Development in Biotechnology	C	60	30	18	12	3+3
BBTM-4065	Fundamentals of Bioinformatics	C	60	30	18	12	3+3
BBTM-4486	Zoology-II	C	60	30	18	12	3+3
BBTF-4067	Industrial/ Institutional Visit	C	20	-	20	-	-
SECS-4522	*Social Outreach	AC	25	-	20	5	-
<b>Total</b>			<b>380</b>				

**\*Marks of these papers will not be added in total marks and only grades will be provided.**

**C-Compulsory**

**AC- Audit Course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**

**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**

**Bachelor of Science (Bio-Technology)**

**Session: 2023-24**

<b>Bachelor of Science (Bio-Technology) Semester-V</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-5061	rDNA Technology-I	C	60	30	18	12	3+3
BBTM-5062	Plant Biotechnology-I	C	60	30	18	12	3+3
BBTM-5063	Animal Biotechnology-I	C	60	30	18	12	3+3
BBTM-5064	Bioprocess Engineering-I	C	60	30	18	12	3+3
BBTM-5065	Biochemical and Biophysical Techniques-I	C	60	30	18	12	3+3
BBTM-5066	Industrial Biotechnology-II	C	60	30	18	12	3+3
SE CJ-5551	*Job Readiness course	AC	25	20	-	5	-
<b>Total</b>			<b>360</b>				

**\*Marks of these papers will not be added in total marks and only grades will be provided.**

**C-Compulsory**

**AC- Audit course**

**Kanya Maha Vidyalaya, Jalandhar (Autonomous)**  
**SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME**  
**Bachelor of Science (Bio-Technology)**  
**Session: 2023-24**

<b>Bachelor of Science (Bio-Technology) Semester-VI</b>							
<b>Course Code</b>	<b>Course Name</b>	<b>Course Type</b>	<b>Marks</b>				<b>Examination Time (in Hours)</b>
			<b>Total</b>	<b>Ext.</b>		<b>CA</b>	
				<b>L</b>	<b>P</b>		
BBTM-6061	rDNA Technology-II	C	60	30	18	12	3+3
BBTM-6062	Animal Biotechnology-II	C	60	30	18	12	3+3
BBTM-6063	Plant Biotechnology-II	C	60	30	18	12	3+3
BBTM-6064	Bioprocess Engineering-II with training	C	60	30	18	12	3+3
BBTM-6085	Chemistry-III	C	60	30	18	12	3+3
BBTM-6066	Biochemical and Biophysical Techniques-II	C	60	30	18	12	3+3
BBTS-6067	Term Paper	C	20	-	20	-	-
<b>Total</b>			<b>380</b>				

**C-Compulsory**

# **B.Sc. Bio-Technology Semester-III**

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3061**  
**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.



**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3061**  
**Fundamentals of Biotechnology**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

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

**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.

**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 & 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 & Society**

Ethical Issues & Regulating the use of Biotechnology: Human cloning, GM microorganisms, Food & 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.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3061(P)**  
**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.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3061(P)**  
**Fundamentals of Biotechnology**  
**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**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.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3062**  
**Immunology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Familiarize with the immune system

**CO2:** Know about different immune cells providing immunity

**CO3:** Inculcate the knowledge of immune response towards microorganisms.

**CO4:** Understand Major Histocompatibility system in relation to disease susceptibility

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3062**  
**Immunology-I**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

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

**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. Active and passive immunization

**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**

Introduction of antigen and antibody, epitope (B cell & T Cell epitope), Introduction to immunogen, molecular basis of immunogenicity and antigenicity, factors influencing immunogenicity. Immunoglobulins: classes and structure, affinity, and avidity. Antigen-antibody interaction. Complement fixing antibodies and complement cascade: Classical, alternative and lectin pathway.

#### **Unit-IV**

MHC class I and class II molecules, structure and function of class I and class II MHC molecules. Organization of Major Histocompatibility complex (MHC) and inheritance, regulation of MHC expression and disease susceptibility. T and B Cells and their response, structure of T-cell antigen receptors: TCR-CD3 complex.

#### **Books Recommended:**

1. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). Kuby Immunology, 8<sup>th</sup> Edition. W.H. Freeman and Company, New York.
2. Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I.M. (2017). Roitt's Essential Immunology, Wiley Blackwell Publishers.
3. Paul, W.E. (2012). Fundamental Immunology, 7<sup>th</sup> Edition, LWW Publishers.
4. Kanfmann, S.H.E., Sher A. and Ahmed, R. (2002). Immunology of Infectious Diseases, ASM Press, Washington, D.C.
5. Roitt, I.M. Brostoff, J. and Male, D.K. (2012). Immunology, 8<sup>th</sup> Edition, Mosby publishers.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3062(P)**  
**Immunology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Collect blood sample by different methods.

**CO2:** Calculate Differential leucocyte count, Total Leucocytes Count and RBC count in the given blood sample

**CO3:** Perform blood group testing

**CO4:** Perform dye exclusion method to isolate mononuclear cells from peripheral blood.



**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3062 (P)**  
**Immunology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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. Collection of blood sample by different methods.
2. Blood group testing.
3. Differential Leucocytes Count.
4. Total Leucocytes Count.
5. Total RBC count
6. Separation of serum and plasma from blood.
7. Isolation of mononuclear cells from peripheral blood and to check their viability by dye exclusion method.

**Books Recommended:**

1. Celis, J.E., Hunter, T. and Carter, N (2005). Cell Biology: A laboratory handbook. 3<sup>rd</sup> Edition, Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4<sup>th</sup> Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4<sup>th</sup> Edition, Wiley Blackwell.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: BBTM-3083**

**Chemistry-II**

**(Theory)**

**COURSE OUTCOME:**

Students will be able to

**CO1:** explain the various reactive intermediates.

**CO2:** explain the bonding between different organic compounds

**CO3:** explain the effect of various substituents on the reactivity of aromatic compounds

**CO4:** learn Molecular chirality, enantiomers, the Cahn-Ingold Prelog R-S notational system, Resolution of enantiomers, chiral centres other than carbon.

**CO5:** understand mechanism of nucleophilic substitution, stereochemistry of  $SN^1$  and  $SN^2$  reactions

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: BBTM-3083**

**Chemistry-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**UNIT-I**

**Reactive intermediates**

Carbocations, carbanions, free radicals, carbenes, arenes and nitrenes (with examples).

Assigning formal charges on intermediates and other ionic species

**Bonding**

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bond, Van der Waals interactions, resonance, hyperconjugation, hydrogen bonding and Inductive and electrometric effects.

**UNIT-II**

**Aromaticity**

Aromatic electrophilic substitution—general pattern of the mechanism, role of  $\sigma$  and  $\pi$  complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts

reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes

### UNIT-III

**Stereochemistry:** Molecular chirality, enantiomers/symmetry in achiral structures, chiral centres in chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration,

the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantiomers, chiral centres other than carbon, prochirality.

### UNIT-IV

**Nucleophilic substitution** :Functional group transformation by nucleophilic substitution, the bimolecular ( $SN^2$ ), mechanism of nucleophilic substitution, stereochemistry of  $SN^2$  reactions, how  $SN^2$  reactions occur, steric effect in  $SN^2$  reactions, nucleophiles and nucleophilicity, the unimolecular ( $SN^1$ ) mechanism of nucleophilic substitution, carbocation stability and the rate of substitution, by the  $SN^1$  mechanism stereochemistry of  $SN^1$  reactions, carbocation rearrangements in  $SN^1$  reactions, solvent effects, substitution and elimination as competing reactions.

### **Books Recommended:**

1. R.T. Morrison and R.N. Boyd, Organic chemistry
2. I. L. Finar, Organic Chemistry, Vol.I, IV ed. J. March, Advanced Organic Chemistry, Reactions Mechanisms and Structure.
3. Schaum's Outlines Series, Theory and Problems of Organic chemistry.
4. I.L. Finar, Problems and their solution in Organic chemistry.
5. J. D. Robert and M. C. Caserio, Modern Organic Chemistry.
6. D. J. Cram and G. S. Hammond, Organic chemistry.
7. J. E. Banks, Naming Organic Compounds - Programmed Introduction to Organic Chemistry
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F. A. Carey, Organic chemistry

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: BBTM-3083 (P)**

**Chemistry-II**

**(Practical)**

**COURSE OUTCOMES:**

Students will be able to

**CO1:** Detect elements (N, S and halogens) in simple organic compounds

**CO2:** Detect functional groups (Aldehydes, ketones carbohydrates, hydrocarbons, Amides, Amines, Carboxylic acids and phenols) in simple organic compounds

**CO3:** Prepare their derivatives of organic compounds.

**CO4:** Confirm the unknown organic compounds by determining its M.P.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: BBTM-3083 (P)**

**Chemistry-II**

**(Practical)**

**Time: 3.0 Hrs.**

**Practical Marks: 18**

**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:**

**Organic qualitative analysis:**

**Complete identification including derivation of following organic compounds:**

- Amides
- Amines
- Carboxylic acids and phenols.

**Organic qualitative analysis:**

**Complete identification including derivation of following organic compounds:**

- Aromatic hydrocarbons
- Aldehydes
- Ketones
- Carbohydrates

**Books Recommended:**

Arthur Vogel (1978), Vogel's Textbook of practical organic chemistry, including qualitative organic analysis, 4th ed., Longman Scientific and Technical

**Bachelor of Science (Biotechnology) Semester – III**

**Session 2023-24**

**Course Code: BTM-3074**

**Botany-II**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the plants and plant cells in relation to water

**CO2:** Understand the chemical contents of the plant products

**CO3:** Know the concept and characteristics of antiseptic, disinfectant and their mode of action.

**CO4:** Know the prevention and control measures of plant diseases and its effect on economy of crops.



**Bachelor of Science (Biotechnology) Semester – III**

**Session 2023-24**

**Course Code: BBTM-3074**

**Botany-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter:**

Eight questions of equal marks (6 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

**Unit-I**

Nutrition, Transport and Stress responses in plants: Macronutrients and micronutrients and their deficiency symptoms; Water relations, osmosis, transpiration, water potential & its components, ascent of sap and transport of organic solutes. Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses.

**Unit-II**

Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO<sub>2</sub> fixation-C<sub>3</sub>, C<sub>4</sub> and CAM pathways.

**Unit-III**

Plant Pathology & epidemiology: Definitions, classification, mode of transmission & control measures of plant diseases; host-pathogen interaction, Disease resistance, phytoalexins, PR proteins. A brief account of the following plant diseases with respect to casual agents, symptoms, epidemiology and their control measures: Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi.

## Unit-IV

Biodiversity: Physical environment; biotic environment; biotic and abiotic interactions. Concept of habitat and niche; Characteristics of a population; population growth curves; population regulation; Major terrestrial biomes; biogeographical zones of India.

### Suggested Readings:

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2<sup>nd</sup> Ed. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5thEd., Academic Press.
7. R.S. Mehrotra and Ashok Aggarwal (2003) Plant Pathology Tata McGraw Hill New Delhi.

**Bachelor of Science (Bio-Technology) Semester- III**

**Session 2023-24**

**Course Code: BBTM-3074 (P)**

**Botany-II**

**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to develop:

**CO1:** Practical skill on plants and plant cells in relation to water

**CO2:** Know the symptoms and control measures of plant diseases and its effect on economy of crops.

**Bachelor of Science (Bio-Technology) Semester- III**

**Session 2023-24**

**Course Code: BBTM-3074 (P)**

**Botany-II**

**(Practical)**

**Time: 3Hrs**

**Practical: 18**

**Instructions for the paper setter:** 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. Estimation of relative water content of leaf.
2. Measurement of osmotic potential of different tissues by Chardokov method.
3. Demonstrate the transpiration pull by mercury method.
4. Demonstration that O<sub>2</sub> is evolved during photosynthesis.
5. Separation of pigments by paper chromatography/TLC method.
6. Study of Plant pathogens (a) Symptoms of the diseases (b) Morbid anatomy of the plants infected with following diseases:

Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi.

**Suggested Readings:**

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2ndEd. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5thEd., Academic Press.
7. R.S. Mehrotra and Ashok Aggarwal (2003) Plant Pathology Tata McGraw Hill New Delhi.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3085**  
**Biochemistry-III**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Develop an understanding of carbohydrates metabolisms in cell

**CO2:** Understand the basics of Kreb's cycle and electron transport chain.

**CO3:** Know the concept of lipid catabolism and its regulation

**CO4:** Understand the various pathways for lipid anabolism along with cholesterol metabolism

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: BBTM-3085**

**Biochemistry-III**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

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

**UNIT-1**

Carbohydrate metabolism: - Biosynthesis and degradation of carbohydrates, glycolysis, gluconeogenesis, feeder's pathways for glycolysis, regulation of carbohydrates metabolism.

**UNIT-II**

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

**UNIT-III**

Lipid digestion, absorption and transport. Lipid Catabolism: Oxidation of fatty acids (Alpha, Beta, Omega oxidation), degradation of triacylglycerol, phosphoglycerides, sphingolipids, regulation of lipid metabolism.

**UNIT-IV**

Lipid anabolism: Synthesis of fatty acids, triacylglycerol, phosphoglycerides, sphingolipids, cholesterol, and regulation of cholesterol metabolism.

**Books Recommended:**

1. Voet, D., Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5<sup>th</sup> Edition, Wiley.
2. Stryer, L. (2015). Biochemistry, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York

3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2011). Biochemistry, 7<sup>th</sup> Edition, Freeman.
4. Nelson, D.L. and Cox, M.M. (2013). Principles of Biochemistry, 7<sup>th</sup> Edition, Freeman
5. Mathew, C.K., Van, K.E. and Anther, K.G. (2012). Biochemistry 4<sup>th</sup> Edition, Addison Wesley.
6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7<sup>th</sup> Edition, CBS Publishers and Distributors, New Delhi.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3085 (P)**  
**Biochemistry-III**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the importance of absorbance maxima

**CO2:** Determine sugar in the given sample

**CO3:** Perform spectral analysis of plant pigments

**CO4:** Separate lipids and other macromolecules from a given sample



**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3085 (P)**  
**Biochemistry-III**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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. Carbohydrate estimation by Dubois method.
2. Determination of reducing sugar using 3,5 dinitrosalicylic acid.
3. (a) Absorbance curve of two dyes  
(b) Spectral analysis of various plant pigments
4. Separation of lipids from wheat grains.
5. Separation of macromolecules using thin layer chromatography.

**Books Recommended:**

1. Celis, J.E., Hunter, T. and Carter, N (2005). Cell Biology: A laboratory handbook. 3<sup>rd</sup> Edition, Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4<sup>th</sup> Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4<sup>th</sup> Edition, Wiley Blackwell.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3066**  
**Molecular Biology**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand genetic material of a cell and DNA replication.

**CO2:** Know the basics of DNA recombination

**CO3:** Understand transcription and RNA processing

**CO4:** Know genes expression and regulation in a cell.

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: BBTM-3066**

**Molecular Biology**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting atleast one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**Unit-I**

DNA as genetic material, Structure of DNA, types of DNA, modes of replication of DNA in prokaryotes and eukaryotes, DNA polymerases, the replication complex: Pre-priming proteins, fidelity of replication. mechanism of replication.

**Unit - II**

DNA recombination in prokaryotes and eukaryotes: molecular mechanisms, Holiday junction model, DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair, insertion elements and transposons: Bacterial and eukaryotic transposons.

**Unit-III**

**Transcription and RNA processing**

RNA structure and types of RNA, transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, initiation, elongation and termination of RNA chains, Transcription in eukaryotes: eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

**UNIT IV**

**Regulation of gene expression and translation**

Regulation of gene expression in prokaryotes: Operon concept (inducible and repressible system): lac, his, trp operons, genetic code and its characteristics, Prokaryotic and eukaryotic translation: ribosome structure and assembly, charging of tRNA, aminoacyl tRNA synthetases, mechanism of initiation, elongation and termination of polypeptides, fidelity of translation, inhibitors of translation, regulation, posttranslational modifications of proteins

**Books Recommended:**

1. Adams, R. L. P., Knowler, J. T., and Leader, D. P. (1992). The Biochemistry of Nucleic acids, 11<sup>th</sup> Edition, Champman and Hall, The New York/London/Tokyo/Melbourne/Madras.
2. Bolsover, S. R., Hyams, J. S., S. Shephard, E. A. and White H. A. (1997). From Genes to Cells., John Wiley and Sons.
3. Krebs, J E, Goldstein, ES, Kilpatrick, ST (2017). Lewin's Gene XII, Jones and Bartlett publishers, Inc.
4. Maulik, S. and Patel, S. D. (1997). Molecular Biotechnology Therapeutic Application and Strategies, John Wiley & Sons.
5. Primrose, SB and Twyman, R. (2010). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
6. Strachan, T. and Read, A. (2010). Human Molecular Genetics, Garland Science
7. Pierce, B. (2016). Genetics: A conceptual approach, 6<sup>th</sup> Edition, WH Freeman.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3066(P)**  
**Molecular Biology**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Isolate genomic DNA and RNA from given samples.

**CO2:** Perform agarose gel electrophoresis for a given DNA sample.

**CO3:** Quantify and determine purity of RNA and DNA.

**CO4:** Do SDS-PAGE electrophoresis of different protein samples.

**Bachelor of Science (Bio-Technology) Semester-III**  
**Session: 2023-24**  
**Course Code: BBTM-3066(P)**  
**Molecular Biology**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

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

**Experiments**

1. Isolation of genomic DNA from plants by CTAB method.
2. Isolation of genomic DNA from blood and perform agarose gel electrophoresis.
3. Quantification and determination of purity of DNA.
4. To perform RNA isolation from plants.
5. Quantification and determination of purity of RNA.
6. SDS-Page electrophoresis of different protein samples.

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2010). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell
2. Sambrook J. and Green M. R. (2013). Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown T.A (2017). Genomes, 3<sup>rd</sup> Edition, Garland Science.

# **Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: AECE-3221**

**Environmental Studies**

**(Compulsory Paper)**

**Time: 3 Hours**

**Max. Marks: 100**

**Theory: 60**

**Project Report: 20**

**CA: 20**

## **Instructions for the Paper Setter:**

The question paper should carry 60 marks. The structure of the question paper being:

**Part-A**, Short answer pattern – 20 marks

Attempt any five questions out of seven. Each question carries 4 marks. Answer to each question should not exceed 2 pages

**Part-B**, Essay type with inbuilt choice – 40 marks

Attempt any five questions out of eight. Each question carries 8 marks. Answer to each question should not exceed 5 pages.

## **Unit 1 The multidisciplinary nature of environmental studies**

Definition, scope and importance, Need for public awareness

## **Unit 2**

### **Natural Resources: Renewable and non-renewable resources:**

Natural resources and associated problems.

- (a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
- (b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- (c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

- (d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- (e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
- (f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

### **Unit 3**

#### **Ecosystems**

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

### **Unit 4**

#### **Biodiversity and its conservation**

- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
- Biodiversity at global, national and local levels
- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity



## **Unit 5**

### **Environmental Pollution**

#### Definition

- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
  
- Disaster management: floods, earthquake, cyclone and landslides

## **Unit 6**

### **Social Issues and the Environment**

- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products
- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
  
- Issues involved in enforcement of environmental legislation
- Public awareness

## **Unit 7**

### **Human Population and the Environment**

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

## **Unit 8**

### **Field Work**

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

### **References:**

1. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
2. Down to Earth, Centre for Science and Environment, New Delhi.
3. Heywood, V.H. & Waston, R.T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
4. Joseph, K. & Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education(Singapore) Pte. Ltd., Delhi.
5. Kaushik, A. & Kaushik, C.P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
6. Rajagopalan, R. 2011. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
7. Sharma, J. P., Sharma. N.K. & Yadav, N.S. 2005. Comprehensive Environmental Studies, Laxmi Publications, New Delhi.
8. Sharma, P. D. 2009. Ecology and Environment, Rastogi Publications, Meerut.
9. State of India's Environment 2018 by Centre for Sciences and Environment, New Delhi
10. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi

**Bachelor of Science (Bio-Technology) Semester-III**

**Session: 2023-24**

**Course Code: SECP-3512**

**Personality Development**

**Time: 3 Hours**

**Max. Marks: 25**

**Theory: 20**

**CA: 05**

**PURPOSE**

To enhance holistic development of students and improve their employability skills.

**INSTRUCTIONAL OBJECTIVES**

- To re-engineer attitude and understand its influence on behaviour.
- To develop inter-personal skills and be an effective goal-oriented team player.
- To develop communication and problem solving skills.
- To develop professionals with idealistic, practical and moral values.

**LEARNING OUTCOMES**

- On completion of the course, students will be able to hone their personality by
- Realisation of the importance and incorporation of positive thinking and attitude in life
- Enhancement of self confidence and analysis of self capabilities
- Learning the different communication skills for self expression
- Effective use of time to combat stress and increase in productivity
- Enhancing personality by physical grooming and fitness
- Understanding the role of design principles and appropriateness of apparel
- Incorporating social etiquettes in daily life and conduct
- Excelling in decision making and leadership qualities

## CURRICULUM

Course credits-2

Total Contact Hours-30

<b>MOD ULE</b>	<b>TITLE</b>	<b>HOUR S</b>
<b>1.</b>	<b>Positive Thinking &amp; Attitude</b>	<b>2</b>
<b>2.</b>	<b>Self Analysis &amp; Self Confidence</b>	<b>2</b>

<b>3.</b>	<b>Communication Skills</b>	<b>10</b>
	<ul style="list-style-type: none"><li>• <b>Basic Communication Skills</b></li><li>• <b>Body Language</b></li><li>• <b>Interview Skills</b></li><li>• <b>Résumé Writing</b></li><li>• <b>Group Discussion</b></li><li>• <b>Telephone and E-mail etiquette</b></li><li>• <b>Public Speaking</b></li></ul>	
<b>4.</b>	<b>Time Management</b>	<b>2</b>
<b>5.</b>	<b>Stress and Conflict Management</b>	<b>2</b>
<b>6.</b>	<b>Physical Fitness and Personal Grooming</b>	<b>2</b>
<b>7.</b>	<b>Appropriateness of Apparel</b>	<b>2</b>
<b>8.</b>	<b>Social Etiquette</b>	<b>2</b>
<b>9.</b>	<b>Decision Making process &amp; Problem Solving Skills</b> <ul style="list-style-type: none"><li>• <b>Leadership Skills</b></li><li>• <b>Goal Setting</b></li><li>• <b>Motivation</b></li></ul>	<b>5</b>
<b>10.</b>	<b>Closure</b>	<b>1</b>

## **EXAMINATION**

1. Total marks of the course will be 25 (Final Examination: 20 Marks; Internal Assessment: 5Marks)
2. The pattern of the final examination will be multiple choice questions. 25 multiple choice type questions will be set. The student shall attempt 20 questions. Each question will carry 1 mark (20 X 1 = 20). Total time allotted will be 1 hour.
3. Internal Assessment will consist of Attendance: 2 Marks, Internal: 3 Marks.( Total Internal Assessment:5 Marks)

## **SYLLABUS**

### **MODULE 1: Positive Thinking & Attitude**

- Factors Influencing Attitude
- Essentials to develop Positive Attitude
- Challenges & lessons from Attitude

### **MODULE 2: Self Analysis & Self Confidence**

- Who am I
- Importance of Self Confidence
- SWOT Analysis

### **MODULE 3: Communication Skills**

#### **(i) Basic Communication Skills**

- Speaking skills
- Listening skills
- Presentation skills

#### **(ii) Body Language**

- Forms of Non-Verbal Communication
- Interpreting body language clues
- Effective use of body language

#### **(iii) Interview Skills**

- Type of Interviews
- Ensuring success in job interviews
- Appropriate use of Non-verbal Communication

#### **(iv) Résumé Writing**

- Features
- Different types of résumé for Different posts

#### **(v) Group Discussion**

- Difference between Group discussion and debate

- Importance of Group Discussion
- Group Decision
- Ensuring success in group discussions

(vi) **Telephone & E-mail Etiquette**

- Telephone etiquette
- E-mail etiquette

(vii) **Public Speaking**

- Introductory speech
- Informative speech
- Persuasive speech
- Extempore session

**MODULE 4: Time Management**

- Importance of time management
- Values & beliefs
- Goals and benchmarks – The ladders of success
- Managing projects and commitments
- Prioritizing your To-do's
- Getting the results you need

**MODULE 5: Stress & Conflict Management**

- Introduction to stress
- Types of stressors
- Small changes and large rewards
- Stress prevention
- Overcoming unhealthy worry
- Stress at home and workplace
- Dealing with frustration and anger
- Stress reducing exercises
- Understanding conflicts
- Violent and Non-violent conflicts
- Source of conflict
- Structural and cultural violence
-

## **MODULE 6: Physical Fitness and Personal Grooming**

- Fitness and exercise
- Balanced & healthy diet
- Skin care & Hair care
- Make-up skills

## **MODULE 7: Appropriateness of Apparel**

- Apparel & Personality
- Psycho-social aspects of apparel
- Style-tips for smart dressing & effective use of design elements

## **MODULE 8: Social Etiquette**

- Civic Sense
- Workplace skills
- Meeting and greeting people
- Table Setting and table manners

## **MODULE 9: Decision Making Process and Problem Solving Skills**

- Anatomy of a decision
- How to use problem solving steps and problem solving tools
- How to distinguish root causes from symptoms to identify right solution for right problems
- How to improve problem solving and decision making by identifying individual problem solving styles
- The creative process for making decisions
- Tools to improve creativity
- Implementing the decision – Wrap up

### **(i) Leadership Skills**

- Handling peer pressure and bullies
- Team work
- Decision making
- Taking initiatives



**(ii) Goal Setting**

- Wish list
- SMART goals
- Blueprint for success
  
- Short-term, Long-term, Life-term Goals

**(iii) Motivation**

- Factors of motivation
- Self talk
- Intrinsic & extrinsic motivators

**Books Recommended**

1. Rossi, P. (2011). *Everyday Etiquette: How to navigate 101 common and uncommon social situations*. St Martins Pr.
2. Pietrzak, T., & Fraum, M. (2005). *Building career success skills*. ASTD Press.
3. Treffinger, D.J., Isaksen, S.G., & Brian, K. (2005). *Creative problem solving: An Introduction*.
4. Carr, A. (2004). *Positive Psychology: The science of happiness and human strengths*. Burnner-Routlrdge.
5. Oberg, B.C. (1994). *Speech craft: An Introduction to public speaking*. Meriwether Publishing.

# **B.Sc. Bio-Technology Semester-IV**

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4061**  
**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) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4061**  
**Industrial Biotechnology-I**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section. Each question carries 6 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.

**Unit-II**

Industrially important microbes, 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. 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, 2<sup>nd</sup> edition, CRC Press.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BBTM-4061(P)**

**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) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4061(P)**  
**Industrial Biotechnology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**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 casein from milk and isoelectric pH of casein.
2. Cheese making by bacterial culture method
3. Determination of fat content in milk.
4. Isolation and screening of amylase producing microbes from soil.
5. Isolation and screening of protease producing microbes from soil.
6. Isolation and screening of cellulase producing microorganism from wood degrading soil.

**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.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4062**  
**Immunology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course, student will be able to

**CO1:** Familiarize with antigens and antibodies.

**CO2:** Understand different types of immunodiffusion techniques.

**CO3:** Have sound knowledge of how immune system deals with various pathogens, and different cell types involved in the prevention of disease.

**CO4:** Know about the concept, synthesis, and action mechanism of vaccines.



**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BBTM-4062**

**Immunology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting atleast one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**Unit-I**

T-cell subsets and surface markers, T-dependent and T-independent antigens, adjuvants, monoclonal antibodies: its production and uses.

**Unit-II**

Various types of immunodiffusions and immunoelectrophoretic procedures. Immunoblot, ELISA, RIA, agglutination of pathogenic bacteria, Hemagglutination and hemagglutination inhibition.

**Unit-III**

Immune invasion: mechanism used by parasites, regulation of immune invasion, immunity to viruses, intracellular and extracellular bacteria, immunopathological consequences of parasitic infections.

**Unit-IV**

Whole organism vaccine, Types of vaccines: purified macromolecules as vaccine, recombinant antigen vaccine, recombinant vector vaccine, synthetic peptide vaccine, multivalent subunit vaccine, DNA Vaccine, RNA Vaccine.

**Books Recommended:**

1. Abbas, A.K. Litchman, A.H. and Pillai, S. (2017). Cellular and Molecular Immunology, 9<sup>th</sup> Edition, Elsevier.
2. Benjamni, E., Coico, R. and Sunshine, G. (2015). Immunology: A short course, 7<sup>th</sup> Edition, New York, Wiley- Wiley-Blackwell.
3. Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I.M. (2017). Roitt's Essential Immunology, Wiley Blackwell Publishers.
4. Roitt, I., Brostoff, J. and Male, D. (2001). Immunology, 6<sup>th</sup> Edition, Mosby.
5. Kanfmann S.H.E., Sher, A., Ahmed, R. (2002). Immunology of infectious Diseases, ASM Press, Washington D.C.
6. Butler, M. (2004). Animal Cell culture and Technology, 2<sup>nd</sup> Edition, Garland Science.
7. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). Kuby Immunology, 8<sup>th</sup> Edition, W.H. Freeman and Company, New York.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4062(P)**  
**Immunology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Learn about vaccines.

**CO2:** Study immunodiagnostic tests.

**CO3:** Perform immunoprecipitation reactions.

**CO4:** Learn protein purification methods.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4062(P)**  
**Immunology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

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

**Experiments**

1. Preparation of vaccine chart of child, highlighting optional vaccines
2. Haemagglutination assay
3. Haemagglutination inhibition assay
4. Double immunodiffusion test using specific antibody and antigen Line of identity, partial identity, and non-identity
5. Single immunodiffusion test using specific antibody and antigen
6. Direct and indirect ELISA
7. To perform Immunoelectrophoresis.
8. Separation and purification of IgG antibodies from Serum using protein A column.

**Books Recommended:**

1. Stevans, C.D. (2003). Clinical Immunology and Serology: A Laboratory Perspective 2<sup>nd</sup> Edition, F.A Davis Company, Philadelphia.
2. Celis, J.E., Hunter, T. and Carter, N. (2005). Cell Biology: A laboratory handbook. 3<sup>rd</sup> Edition, Vol-III, Academic Press, U.K.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4<sup>th</sup> Edition, Wiley Blackwell

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BBTM-4083**

**Biochemistry-IV**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Know the basics of amino acid biosynthesis and their regulation.

**CO2:** Have knowledge of degradation pathways of amino acids along with disorders of amino acid metabolism

**CO3:** Understand the biosynthetic pathways of purines and pyrimidines nucleotides

**CO4:** Know the degradative pathways of purines and pyrimidines

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BBTM-4083**

**Biochemistry-IV**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**UNIT-I**

Amino acid metabolism: Overview of amino acid metabolism. Glucogenic and ketogenic amino acids. Biosynthesis of essential amino acids, regulation of amino acid biosynthesis by feedback inhibition

**UNIT-II**

Amino acid metabolism: Transamination reactions of amino acids, deamination and decarboxylation reactions, role of pyridoxal phosphate, urea cycle and inherited defects of urea cycle. Catabolism of essential amino acids, disorders of amino acids metabolism, phenylketonuria, alkaptonuria, maple syrup urine disease, methylmalonic acidemia (MMA), homocystinuria

**UNIT-III**

Nucleic acid metabolism: Structure of purine and pyrimidine bases, nucleosides, and nucleotides. Biologically important nucleotides. Biosynthesis of purines and pyrimidines nucleotides. Clinical significance of purine biosynthetic pathway.

**UNIT-IV**

Nucleic acid metabolism: Degradation of purines and pyrimidines, nucleotides, salvage pathway, regulation of nucleotide biosynthesis.

**Books Recommended:**

1. Jain, J. L., Jain, S. and Jain. N. (2016). Fundamentals of Biochemistry, S. Chand & Company Ltd., New Delhi.
2. Rawn, J.D. (1989). Biochemistry, Niel Patterson Publications, North Carolina.
3. Berg, J.M., Tymoczko, J.L., Gatto, G.L., Stryer, L. (2015). Biochemistry, 4<sup>th</sup> Edition., W.H. Freeman & Co., San Francisco.
4. Voet, D., Voet, J.G. (2012). Fundamentals of Biochemistry, John Wiley and Sons, New York.
5. Nelson, D.L. and Cox, M.M. (2017). Lehninger's Principles of Biochemistry, 7<sup>th</sup> Edition., WH Freeman, New York.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4083(P)**  
**Biochemistry-IV**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Quantitatively estimate amino acids

**CO2:** Acquire skills to perform protein purification by using salt precipitation

**CO3:** Estimate nucleic acid concentration

**CO4:** Understand effect of mutagens on bacteria



**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4083(P)**  
**Biochemistry-IV**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

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

**Experiments:**

1. Quantitative estimation of amino acids using the Ninhydrin reaction.
2. Purification of protein using salt precipitation.
3. Estimation of DNA by Diphenyl reaction
4. UV induced mutagenesis

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4064**  
**Skill Development in Biotechnology**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Acquire the knowledge of food fermentation industry

**CO2:** To gain the knowledge about various adulterants in food along with principles of government regulatory bodies

**CO3:** Understand the nutritional aspects of the biomolecules, balanced diet and disorders related to nutrition.

**CO4:** Understand food spoilage and detection

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4064**  
**Skill Development in Biotechnology**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**Food biotechnology**

**Unit-I**

Commercial potential of food fermentation industry; novel food ingredients: Low calorie sweetener, plant tissue culture and naturally produced flavor modifiers, natural food coloring agents; nutraceuticals: Probiotics, food spoilage: Detection and mechanism of food borne infections (*Clostridium*, *Salmonella*, *Staphylococcus*, *Aspergillus* sp.)

**Unit-II**

Introduction to HACCP plan, preservation: thermal processing, cold preservation, chemical preservatives, food dehydration, food irradiation, biological control; quality assurance: biochemical/microbial testing of food adulterants: milk, butter, oil, jams, jellies, government regulatory practices and policies (FSSAI, FDA etc.), food packaging: need and ways (glass, metal, plastics, molded pulp, and aluminium foil).

**Dietetics and nutrition management**

**Unit-III**

Energy value of biomolecules: carbohydrates, fats and proteins, basal metabolic rate definition and its measurement, factors affecting BMR, energy requirements of human beings, energy requirements in different age groups and special conditions (pregnant ladies and lactating mothers), different dietary types, requirements, utilization, and functions. Methods of protein determination, amino acid imbalance, protein requirements, utilization and functions, nutritional aspects of vitamins and minerals, food processing and loss of nutrients during processing and cooking, naturally occurring anti-nutrients, balanced diet, recommended dietary allowances for different categories of human beings, disorders related to nutrition-protein energy malnutrition, starvation, and obesity.

## **Unit-IV**

### **Food spoilage and detection**

Intrinsic and extrinsic factors responsible for food spoilage, microorganisms involved in food spoilage: fruits, vegetables, meat, eggs, bread, methods of detection of food spoilage: Traditional approaches: SCP, Breeds smear, identification of specific organisms by using selective and differential media. New approaches: use of gene probes, RDT, bioluminescence.

#### **Books Recommended:**

1. Frazier, W.C. and Westhoff, D.C. (2013). Food microbiology (Tata McGraw-Hill publishing Co. Ltd).
2. Admas, M.R. and Moss, M.O. (2015). Food microbiology, 4<sup>th</sup> Edition, Royal Society of Chemistry).
3. SriLakshmi B. (2018). Food science, 7<sup>th</sup> Edition, New Age International Publishers, India.
4. Jay J.M., Loessner M.J. and Golden D.A. (2006). Modern Food Microbiology, 7<sup>th</sup> Edition, Springer India.
5. Sivasankar B. (2004). Food processing and preservation, 1<sup>st</sup> Edition, Prentice-Hall of India Pvt. Ltd, New Delhi.
6. Michael P. Doyle, Larry R. Beuchat (2007). Food Microbiology: Fundamentals and Frontiers, 3<sup>rd</sup> Edition, ASM Press.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4064(P)**  
**Skill Development in Biotechnology**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Check different food adulterants in the given products.

**CO2:** Determine crude fibre and protein content in food samples.

**CO3:** Give quality index of fats content in different food samples.

**CO4:** Calculate amount of energy expended by a human while at rest.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4064(P)**  
**Skill Development in Biotechnology**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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. Detection of adulteration in food (oil, butter).
2. Determination of crude fibre content in wheat and chickpea.
3. Determination of gluten content in wheat flour.
4. Determination of fat content in different food products.
5. Determine the BMR.

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4065**  
**Fundamentals of Bioinformatics**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand basics of computer and data storage devices

**CO2:** Understand basics of bioinformatics and sequence alignment

**CO3:** Know about scoring matrices and database searching

**CO4:** Know about primary and secondary databases

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4065**  
**Fundamentals of Bioinformatics**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**UNIT-I**

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

**UNIT-II**

Introduction to bioinformatics: History, milestones and applications, local and global alignments, gap Penalties, pairwise sequence alignments (Needleman-Wunsch, Smith-Watermann Algorithms), significance of sequence alignment.

**UNIT-III**

**Scoring Matrices:** PAM, BLOSUM,

**Multiple Sequence Alignment:** Progressive alignment, iterative alignment methods,

**Database Searching:** BLAST and its types

**UNIT-IV**



Primary and secondary databases, online resources of bioinformatics: Introduction: NCBI, EBI, DDBJ, Expasy, PUBMED, PDB, UNIPROT, Pfam, Prosite.

**Books Recommended:**

1. Norton's P. (2017). Introduction to Computing Fundamental, 7<sup>th</sup> Edition, McGraw Hill Education, New Delhi.
2. Sinha P.K. (2010). Fundamental of Computers, 8<sup>th</sup> Edition, BPB Publication, New Delhi.
3. Jin Xiong. (2006) Essential Bioinformatics. Cambridge University Press.
4. Baxevais B.F. and Quellette F. (2004). Bioinformatics a Practical Guide to the Analysis of Genes and Proteins, 3<sup>rd</sup> Edition, Wiley-Interscience

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4065 (P)**  
**Fundamentals of Bioinformatics**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Use and perform MS -office

**CO2:** Know and use various databases

**CO3:** Perform sequence alignment

**CO4:** Perform prediction of protein functional domain

**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTM-4065 (P)**  
**Fundamentals of Bioinformatics**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

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

**Experiments:**

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

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BBTM-4486**

**Zoology-II**

**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand evolution of Prokaryotes and Eukaryotes.

**CO2:** Understand the process and theories in evolutionary biology.

**CO3:** Aware the students about various pathogenic protozoans and helminths and diseases caused by them in humans.

**CO4:** Understand diseases caused by arthropod vectors and their control measures.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BTM-4486**

**Zoology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

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

**Unit-1**

**Origin of Life on Earth:** Origin of earth and primitive earth conditions, Theories of origin of life (Theory of Extraterrestrial contact- Import of life through meteorites, Special creation theory, OparinHaldane Theory, Abiogenesis , Evidences against theory of spontaneous generation of life, Biogenesis, Theory of chemical evolution, Miller & Urey Experiment).

Evolution of Prokaryotes and Eukaryotes (unicellularity to multicellularity).

**Unit-2**

**Evolution:** Definition, Scope and History, Theories of Evolution (Lamarckism, Darwinism, Hugo deVries and Modern theory of Evolution).

Geological time scale.

### **Unit-3**

**Introduction to Parasitology** (pertaining to various terminologies in use).

Brief account of Life history, mode of infection and pathogenicity of the following pathogens with reference to man, prophylaxis and treatment.

**Pathogenic Protozoans:** Entamoeba, Trypanosoma, Giardia and Plasmodium.

**Pathogenic Helminths:** Tape Worm, Ascaris and Ancylostoma.

### **Unit-4**

**Arthropod vectors of human diseases:** Malaria, Yellow fever, Dengue haemorrhagic fever, Filariasis, Plague and Epidemic typhus.

Distribution and control of the above mentioned vectors.

#### **Books:**

1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publishers

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2023-24**

**Course Code: BBTM-4486(P)**

**Zoology-II**

**(Practical)**

4.

**COURSE OUTCOMES**

After passing this course the student will be able to:

**CO1:** Aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.

**CO2:** Aware about the typhoid, cholera like disease.

**CO3:** Understand the evolutionary phenomena.

**Bachelor of Science (Bio-Technology) Semester-IV**

**Session: 2022-23**

**Course Code: BBTM-4486(P)**

**Zoology-II**

**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

Note. The question paper will be set by the examiner based on the syllabus.

1. Study of Evolutionary phenomenon with the help of charts / models / videos:

**Homology, Analogy and Mimicry.**

2. Study of the skeleton of human.
3. Study of the following prepared slides: histology of man (compound tissues).
4. Study of following prepared slides/specimen :

**Pathogenic Protozoans:** Entamoeba, Trypanosoma, Giardia and Plasmodium.

**Pathogenic Helminths:** Tape Worm, Ascaris and Ancylostoma.

**Arthropod vectors of human diseases:** Anopheles, Culex, Aedes Mosquitoes, Rat flea.

**Books:**

1. Sobti, R.C. & Nigam, S.K. (2002). Structural & function biology of chordates, Vishal Publishers, Jalandhar.
2. Sobti, R.C. & Sharma, V.L. (2005). Basics of Biotechnology: Introduction of Life Sciences. Vishal Publishers, Jalandhar.
3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools and Application, Vishal Publisher



**Bachelor of Science (Bio-Technology) Semester-IV**  
**Session: 2023-24**  
**Course Code: BBTF-4067**  
**Industrial/ Institutional Visit**

**Time: 3 Hours**

**Max. Marks: 20**

**Note:**

Students will go for a visit to industry/institute and the students will be required to submit written report for the same which will be evaluated.

## **Bachelor of Science (Bio-Technology) Semester-IV**

**Session:2023-24**

**Course Code: SECS-4522**

### **Social Outreach Programme**

#### **Course Objectives:**

- The Social outreach program proposes to equip the students for community upliftment work.
- It will strive to prepare citizens who will make a marked difference in society.
- The students will be provided with numerous opportunities to build their knowledge and skills on the fundamental values of social fairness and compassion.
- The program will focus on integrating academic work with community services

#### **Learning Outcomes:**

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

- connect the knowledge gained in the classroom with real-life situations by getting hands-on experience through community services.
- get an opportunity to engage in social service. It will also foster the development of civic responsibility.
- reflect upon larger issues that affect communities through readings and discussions.
- integrate academic learning and community engagement through practical fieldwork.
- develop awareness, knowledge, and skills for working with diverse groups in society.

#### **Curriculum**

The curriculum involves two aspects:

- A. Students will be introduced to various broad areas in which they can take up projects
- B. The students are expected to be actively engaged in working on any of the project areas listed below as volunteers. Evaluation will be based on consistency, commitment, and results achieved in the areas taken up.

<b>MO DU LE</b>	<b>TOPI C</b>	<b>HOURS</b>
1.	Sensitizing the students towards Social Issues	3
2.	Collaborating with NGOs	1
3.	Social Extension in villages & literacy drive	1
4.	NSS, Swatch Bharat, Unnat Bharat	1
5.	Projects related to Environmental issues/NCC	1
6.	Setting up Empathy Corners	1
7.	Food Adulteration and Medical Camps	1
8.	Medical Camp/ Adulteration Camp / Science Awareness Camp in Villages	1
Total Hours of interactive Sessions		10
Hours for Project Work:		20

**List of Projects Areas under Social Outreach Program:**

- Working as Motivators under the Swatch Bharat Campaign of the Government,
- Literacy drive: (I). Teaching in the Charitable School Adopted by the College(ii). Work on projects undertaken by the Rotary Club of Jalandhar for inducting students into child labor Schools.
- Enroll as NSS Volunteers for various projects (Cleanliness, Women's health awareness)
- Counseling camps in villages
- Tree plantation (i) Maintaining the trees in the park adopted by the college.in Vikas Puri, Jalandhar  
(ii) Enroll in projects undertaken by JCI Jalandhar City

- Enroll in the Gandhian Studies Centre as a Student Volunteer for surveys in villages.
- Women Empowerment Programmes in collaboration with JCI Jalandhar Grace
- Generating awareness on voting among the youth.
- Drug Abuse (Generate awareness among the school children)
- Environment Awareness (Reduce Pollution, Plant trees, and work as waterwarriors)
- Visit Old Age Homes/Orphanages
- Operating the Empathy Corner outside the college gate and setting up empathy corners in Villages.
- Help in Disaster Management/Relief Work
- Organize Food Adulteration and Medical Camps in Villages
- Organize Science Awareness Camps in Villages

#### **Evaluation /Assessment:**

At the beginning of the semester, the students after enrolling for one of the Projects offered will be given deadlines for the project.

- Students will be responsible for recording their hours of service with the faculty and also map the progress of their subjects (children, old people, saplings, etc.).
- The respective departments will monitor the involvement of their students.
- The students will submit a report of the project taken up by them.
- There will be no written examination, The students will be given a grade based on the evaluation of the projects by an evaluation committee, comprising of the Dean of the respective streams, the Head, and two teachers of the concerned department.

**Total Marks: 25 (Internal Assessment: 5 and Project Report: 20)** Internal Assessment based on the attendance during the Lectures Project Report based on the work done by the student.

#### **Total marks: 25 converted to grade for final result Grading system:**

90% marks & above: A grade 80% - 89% marks: B grade 70% -79% marks : C grade

60% - 69% marks : D

grade 50% - 59% marks : E grade

Below 50% marks : F grade (Fail – To repeat Project)

# **B.Sc. Bio-Technology Semester-V**

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5061**  
**rDNA Technology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the concept of rDNA technology and tools used in recombinant DNA technology.

**CO2:** Know about cloning vectors used in recombinant DNA technology.

**CO3:** Understand gene cloning and different methods of transformation.

**CO4:** Know labelling of nucleic acids.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5061**  
**rDNA Technology-I**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setters:**

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

**Unit-I**

Introduction to genetic engineering. Why gene cloning and DNA analysis is important. What is clone, how to clone a gene: Overview of the procedure.

Tools in Recombinant DNA Technology: Restriction and modifying enzymes, Type I, Type II and Type III enzymes and their characteristic features; restriction sequences, isoschizomers, rare cutting enzymes, enzyme cutting similar sequence in different manner.

DNA modifying enzymes: Characteristics and applications of Nucleases – DNase and RNase, DNA-Pol I, Klenow fragment, T4DNA polymerase, T7 DNA polymerase, T4 Polynucleotide kinase, Phosphatase, Reverse transcriptase, Taq polymerase and Ligase. Terminal deoxynucleotidyl transferase, reverse transcriptase. RNase-H, DNase-I, Nuclease S-I

**Unit-II**

Cloning vectors: Basic features of plasmids, role of antibiotics and resistance genes in a vector, multiple cloning site, copy number regulation, pBR 322, pUC 8, Bacteriophage  $\lambda$  based vectors: insertional and replacement vectors, phagemid, cosmid, fosmid. Isolation and purification of DNA from bacteria, plants, animals and soil.

**Unit-III**

Gene Cloning: Ligation, methods of transformation:  $\text{CaCl}_2$ , electroporation, transfection, micro projectile. Transformation efficiency, screening of transformants by gene inactivation: antibiotic inactivation and blue white selection.

**Unit-IV**

Labelling of DNA and RNA- Radioactive labelling (Nick Translation, Random priming, nd Labelling), Non-Radioactive labelling (Direct & indirect non isotopic labelling), gene identification: Nucleic acid hybridization (Southern and northern blotting), western blotting.

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown TA. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science.
4. Glick, B. R., & Pasternak, J. J (2010). Molecular biotechnology- principles and applications of recombinant DNA. Washington: ASM Press.
5. Clark, D. P. & Pazdernik, N. J. (2009). Biotechnology- applying the genetic revolution. USA: Elsevier Academic Press.



**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5061(P)**  
**rDNA Technology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Isolate genomic DNA.

**CO2:** Quantify DNA using Spectrophotometry.

**CO3:** Learn electrophoresis.

**CO4:** Perform and understand concept of cloning and transformation

**Bachelor of Science (Bio-Technology) Semester-V**

**Session: 2023-24**

**Course Code: BBTM-5061(P)**

**rDNA Technology-I**

**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**Instructions for the practical Examiner:**

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

**Experiments:**

1. Isolation of genomic DNA from bacteria.
2. Confirmation of high molecular weight DNA on agarose gel.
3. To perform spectrophotometric quantification of DNA for determination of purity.
4. Restriction enzyme digestion of isolated DNA.
5. Preparation of competent cells
6. Transformation of competent cells by  $\text{CaCl}_2$  method.

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown TA. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5062**  
**Plant Biotechnology-I**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

- CO1:** Study the macronutrients and micronutrients and their deficiency symptoms in plants.
- CO2:** Know about the different physiological functions and biosynthesis of major plant growth regulators.
- CO3:** Understand the concept of totipotency and differentiation.
- CO4:** Understand the different methods of gene transfer in plants.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5062**  
**Plant Biotechnology-I**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setters:**

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

**Unit-I**

Introduction to plant tissue culture and its historical background, Plant nutrition: macronutrients and micronutrients and their deficiency symptoms. Plant tissue culture media: types, components, and their role.

**Unit-II**

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

**Unit-III**

Totipotency, factors affecting cellular totipotency, cell differentiation, dedifferentiation and redifferentiation of cells. Tissue competency, plant-explant-plant concept. Factors influencing plant tissue culture: Genotypic, physiological, biochemical, and other extrinsic factors.

**Unit IV**

Transgenic plant biotechnology: Methods of gene transfer - Direct (Electroporation, microprojectile, microinjection, PEG mediated, DEAE Dextran mediated methods) and indirect (agrobacterium mediated gene transfer).

**Books Recommended:**

1. Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
2. Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
3. Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
4. Smith, RH. (2012) Plant tissue culture: techniques and experiments, Gulf professional publishing

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5062 (P)**  
**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 and inoculate explant.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5062 (P)**  
**Plant Biotechnology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Max. Marks: 18**

**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.
5. Preparation of stock solutions of Murashige and Skoog (1962) medium.
6. Preparation of Murashige and Skoog's medium from stock solutions.
7. Different sterilization process (Instruments, glassware and thermolabile and thermostable components)
8. Selection, preparation, sterilization, and inoculation of explants.

**Books Recommended:**

1. Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
2. Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
3. Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
4. Smith, RH. (2012) Plant tissue culture: techniques and experiments, Gulf professional publishing

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5063**  
**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: 2023-24**  
**Course Code: BBTM-5063**  
**Animal Biotechnology-I**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

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

**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, P4 facility and their applications. Introduction to concept of biosafety and biosecurity.

**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 & 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. Gareth, EJ. (2016). Human Cell Culture Protocols, Humara Press.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.
3. Julio, E., Celis (2006). Cell Biology-A laboratory hand book, Vol. I-IV, Academic Press, New York.
4. Freshney, RT. (2016), Culture of Animal Cells 7<sup>th</sup> Edition, John Wiley and Sons, New York



**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5063(P)**  
**Animal Biotechnology-I**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform different sterilization techniques in ATC lab.

**CO2:** Prepare media used in animal tissue culture

**CO3:** Isolate lymphocytes and macrophages from blood.

**CO4:** Check cell viability

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5063(P)**  
**Animal Biotechnology-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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 -Glass ware 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. Isolation of lymphocytes for culturing and perform cell viability test.
6. Isolation of macrophages from blood for culturing

**Book Recommended:**

1. Freshney, RT. (2016), Culture of Animal Cells. 7<sup>th</sup> Edition, John Wiley and Sons, New Delhi.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5064**  
**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.

**Bachelor of Science (Bio-Technology) Semester-V**

**Session: 2023-24**

**Course Code: BBTM-5064**

**Bioprocess Engineering-I  
(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

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

**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**

Introduction to multistage feedback systems: Internal and external feedback systems, effector molecules (Enzyme inhibitors and enzyme activators) and their kinetics, effect of temperature, pH and inducer on product synthesis.

**Unit-IV**

**Sterilization:** Introduction, air and media sterilizations, design of batch sterilization process, Methods of batch sterilization, Del factor, sterilization cycle, continuous sterilization of feeds and liquid wastes, filter sterilization, sterilization of fermenters.

**Books Recommended:**

1. Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 2<sup>nd</sup> Edition., Pergamon Press, Oxford.
2. Young, MY. (2000). Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.
3. Young, MY. (1996). Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.
4. Bailary, JE. and Ollis, DF. (1986). Biochemical Engineering Fundamentals, McGraw Hills, New York.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5064 (P)**  
**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: 2023-24**  
**Course Code: BBTM-5064(P)**  
**Bioprocess Engineering-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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 along with method of validation.

**Books Recommended:**

1. Cappuccino JG., Sherman N. (2007). Microbiology: A laboratory, Pearson Benjamin Cummings.
2. Plummer DT. (2004). An introduction to practical biochemistry, Tata McGraw Hill Publishers Co. Ltd., New Delhi.
3. Bansal, DD., K Hardori, R., Gupta, MM. (1985). Practical biochemistry, Standard Publication Chandigarh.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5065**  
**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: 2023-24**  
**Course Code: BBTM-5065**  
**Biochemical and Biophysical Techniques-I**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setters:**

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

**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. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman.
5. Mousumi, D. (2011). Tools and techniques of biotechnology. Jaipur, India: Pointer Publisher.



**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5065**  
**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:** Study sedimentation using different rotors.

**CO3:** Separate proteins by different chromatography methods.

**CO4:** Separate biomolecules by different chromatography techniques.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5065(P)**  
**Biochemical and Biophysical Techniques-I**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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 bucket rotor and angle rotor.
2. To study differential centrifugation.
3. To study separation of bio-molecules by paper and thin layer chromatography.
4. Separation of proteins by ion-exchange column chromatography
5. Separation of proteins by affinity column chromatography.

**Books Recommended:**

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5066**  
**Industrial Biotechnology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Know about the production of antibiotics and solvents along with xenobiotic degradation and fuel biotechnology.

**CO2:** Understand concept of biotransformation and microbial production of organic acids, vitamins, and amino acids

**CO3:** Know about transgenic crops along with study of various biocontrol agents.

**CO4:** Know about the concept of biological nitrogen fixation

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BTM-5066**  
**Industrial Biotechnology-II**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

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

**Unit-I**

Antibiotics production: Penicillin and streptomycin, pharmaceutical drugs, solvent production: Acetone, butanol and ethanol. Biodegradation of xenobiotic compound. Fuel biotechnology: Types of biofuels and feedstocks for production of biofuel, biogas production, industrial alcohol production

**Unit-II**

Biotransformation, organic acids: production of citric Acid and acetic acid, microbial production of vitamin B12 and vitamin C, amino acids: Glutamic acid and lysine production, alcoholic beverages: wine, beers.

**Unit-III**

Introduction to BT gene, transgenic crops (BT cotton and maize) and their potentials in agro industry, SCP: Spirulina from Yeast and Bacteria, soil treatment with microbes, vermicomposting, production of bacterial biofertilizers, biocontrol agent and their significance, mycorrhizal fungi,

**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, symbiotic and non-symbiotic bacteria, phosphate solubilizing bacteria.

**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*, 2<sup>nd</sup> edition, CRC Press.

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5066(P)**  
**Industrial Biotechnology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the concept of additive and synergistic effect of antibiotics

**CO2:** Perform different types of fermentation

**CO3:** Isolate nitrate reducing bacteria from the environment

**CO4:** Learn about wine production

**Bachelor of Science (Bio-Technology) Semester-V**  
**Session: 2023-24**  
**Course Code: BBTM-5066(P)**  
**Industrial Biotechnology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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. Additive and synergistic effect of two antibiotics on the above microorganism.
3. Minimum inhibitory concentration of an antibiotics for the above microorganism.
4. Demonstration of wine production by using grape juice.
5. 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 introducaiton 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.

## **Bachelor of Science (Bio-Technology) Semester-V**

**Session: 2023-24**

**Course Code: SECJ-5551**

**Job readiness Course**

**(Practical)**

### **Objectives of the Course:**

It is a specialised programme structured to prepare the students ready and adaptable for their professional career. The students will be able to set goals for themselves with the exposure provided to them during the course. The main purpose of the course is to enhance their life skills, increase their capacities for adapting to professional environment and teaming up. They will learn the importance and art of synergising with others and working in teams. It will help them to realize their potential and set high but realistic goals.

### **Learning Outcomes:**

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

- Build confidence and have positive attitude
- Have an overview and exposure of job markets to realize their potential
- Get inputs on critical thinking and leadership qualities
- Comprehend how speaking skills can help them excelling in job interviews
- Acquire knowledge of team work
- Share their ideas in the group and improve their listening skills
- Learn skills of self-introduction to represent themselves and to write a well drafted resume

## **CURRICULUM**



<b>M O D U L E</b>	<b>TITLE</b>	<b>HOURS</b>
I	Goal Setting and Ambition	2 Hours
II	Positive Attitude and Self Confidence	2 Hours
III	Career Options and Job Markets	2 Hours
IV	Resume Building	4 Hours
V	Presentation Skills	4 Hours
VI	Public Speaking	4 Hours
VII	E-Mail Etiquette and Telephonic Conversation	2 Hours
VII I	Organizational Structure and Corporate Jargons	2 Hours
IX	Personal Interviews	4 Hours
X	Final Assessment, Feedback and Closure	4 Hours

## **EXAMINATION**

- **Total Marks:** 25 (Exam: 20 and Internal Assessment: 5)
- **Final Exam:** Multiple Choice Quiz and/or practice/mock tests - Marks – 20; Time: 1 to 2 hours depending upon the batch size of 10-20 participants
- **Internal Assessment:** 5 (Assessment: 3; Attendance:2)
  - o Comparative assessment questions (medium length) in the beginning and at closure of the programme. Marks: 3; Time: 0.5 hour each at the beginning and end.
- **Total marks:** 25 converted to grade for final result

➤ **Grading system:**

90.1% -100% marks: O grade

80.1% - 90% marks: A+ grade

70.1% - 80% marks: A grade

60.1% - 70% marks: B+ grade

50.1% -60% marks: B grade

45%- 50 % marks: C grade

35%-44.9% marks: P grade

Below 35% marks: F grade

Absent: Ab

# **B. Sc. Bio-Technology Semester-VI**

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6061**  
**rDNA Technology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand basics of cloning vectors.

**CO2:** Understand basics of expression vectors.

**CO3:** Understand the concept of gene amplification.

**CO4:** Understand different generations of sequencing.

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2023-24**

**Course Code: BBTM-6061**

**rDNA Technology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**UNIT-I**

Cloning vectors: Shuttle vectors and BAC, overview of cloning, genomic cloning in Lambda vector, screening of recombinants, calculating number of clones that have to be screened, linker, adapters, different strategies for cDNA cloning- self priming and adaptor/linker methods. Cloning vectors for Eukaryotes (yeast vectors, YAC, viral vectors, Ti and Ri plasmids)

**UNIT-II**

Gene expression: expression vectors with respect to different promoters (lac, tac, T5, T7, lamda) and their induction system, signal sequences (omp), tags (His, GST, MBP and IMPACT), selection of host with respect to promoter, processing of recombinant proteins: soluble proteins, inclusion body, protein refolding

**UNIT-III**

Basics of PCR, primer designing, various types of PCR, applications of PCR, PCR based methods of site directed mutagenesis (overlap extension and cassette mutagenesis), random mutagenesis and gene cloning

**UNIT-IV**

DNA Sequencing: Sanger-Coulson method (chain termination method), Maxam- Gilbert method (chemical degradation of DNA), new generation sequencing (Illumina (Solexa) HiSeq, pyrosequencing), Ion Torrent

technology, Single-molecule real-time (SMRT) sequencing, fundamental concepts and applications of microarray, phage display and selection of mutant peptides, yeast two hybrid assay.

**Books Recommended:**

1. Primrose, S.B. and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J. and Green M.R. (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown, T.A. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science.
4. Glick, B. R., and Pasternak, J. J (2003). Molecular biotechnology- Principles and applications of recombinant DNA, ASM Press, Washington.
5. Clark, D. P. and Pazdernik, N. J. (2009). Biotechnology- applying the genetic revolution, Elsevier Academic Press.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6061(P)**  
**rDNA Technology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform cloning.

**CO2:** Understand the concept of transformation

**CO3:** Isolate RNA from given samples.

**CO4:** Amplify genes using PCR.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6061(P)**  
**rDNA Technology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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. Transformation of cells and confirmation of the transformants for the presence of plasmid by blue white selection
5. Isolation of RNA from blood.
6. To perform polymerase chain reaction

**Books Recommended:**

1. Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8<sup>th</sup> Edition, Wiley Blackwell.
2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4<sup>th</sup> Edition, CSHL.
3. Brown TA. (2017) Genomes, 4<sup>th</sup> Edition, Garland Science



**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6062**  
**Animal Biotechnology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand the basics of organotypic and histotypic culture along with tissue engineering.

**CO2:** Understand about transfection methods and expression vectors

**CO3:** Know about monoclonal antibodies and stem cells and their benefit for human.

**CO4:** Understand the role of genetic engineering in the improvement of animal cell for human welfare.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6062**  
**Animal Biotechnology-II**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**  
**Theory: 30**  
**Practical: 18**  
**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting atleast one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**Unit- I**

Commonly used animal cell line, their origin and characteristics (WI-38, MRC-5, IMR-90, HEK-293, HeLa, A 549), differentiation of cells, organotypic and histotypic cultures: Organotypic culture: Gas and nutrient exchange, structure integrity, growth, differentiation, advantages and applications. Methods, advantages and applications of histotypic culture. Three dimensional culture and tissue engineering: Concept of tissue engineering, components of tissue engineering, cells imaging in 3D construct.

**Unit- II**

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- Basics, embryonic and adult stem cells and their applications, transdifferentiation.

**Unit-IV**

Genetic engineering in animal Cells: Methodology for transgenic animals (Mice, rabbit, cattle, goat, sheep, pigs, fish) production of regulatory proteins, blood products, vaccines and hormones, transgenic animal as bioreactor, animal cloning- IVF & embryo transfer, benefits and concerns surrounding the use of animal biotechnology

### **Books Recommended**

1. Gareth, EJ. (1996). Human Cell Culture Protocols, Humara Press.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.
3. Julio, E., Celis (1998). Cell Biology-A laboratory hand book, Vol. I-IV, 2<sup>nd</sup> Edition, Academic Press, New York.
4. Freshney, RT. (2016), Culture of Animal Cells 7<sup>th</sup> Edition, John Wiley and Sons, New York.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6062(P)**  
**Animal Biotechnology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Maintain cultures of animal cells and established cell lines with good viability, minimal contamination and appropriate documentation.

**CO2:** Perform supportive tasks relevant to cell culture, including preparation and evaluation of media, cryopreservation and recovery, and assessment of cell growth and health.

**CO3:** Recognise and troubleshoot problems common to routine cell culture.

**CO4:** To Learn different methods and techniques of animal tissue culture.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6062(P)**  
**Animal Biotechnology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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. Determination of the IC<sub>50</sub> value of a drug using MTT assay

**Book Recommended:**

1. Freshney, RT. (2016), Culture of Animal Cells. 7<sup>th</sup> Edition, John Wiley and Sons, New Delhi.
2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BTM-6063**  
**Plant Biotechnology-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Understand basic concepts of micropropagation.

**CO2:** Understand the concept of embryo culture and somaclonal variations.

**CO3:** Learn the concept of protoplast fusion and somatic cell hybridization

**CO4:** Understand the secondary metabolite production in bioreactors.

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2023-24**

**Course Code: BBTM-6063**

**Plant Biotechnology-II**

**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting atleast one question from each section. The fifth question may be attempted from any section. Each question carries 6 marks.

**Unit I**

Micropropagation methods (axillary bud, shoot-tip and meristem culture), Stages of micropropagation, Factors affecting micropropagation and technical problems, Applications of micropropagation, Acclimatization of tissue culture raised plants. Modes of regeneration, Somatic embryogenesis and organogenesis, Types of somatic embryogenesis, Applications of somatic embryogenesis.

**Unit II**

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

**Unit-III**

Protoplast isolation and culture, viability of protoplasts, protoplast fusion, selection of somatic hybrids and cybrids, applications of somatic cell hybridization.

**Unit-IV**

Cell suspension culture, production of secondary metabolites by plant tissue culture, immobilized plant cell culture, use of bioreactors in secondary metabolite production, transgenic approaches in secondary metabolite production.

**Books Recommended:**

1. Bhojwani, S.S, and Razdan, M.K. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
2. Razdan, M.K. (2019) Introduction to Plant tissue culture, Science Publishers.
3. Singh, B.D. (2021) Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6063(P)**  
**Plant Biotechnology-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Perform micropropagation techniques.

**CO2:** Learn different pathways of plant regeneration under *in vitro* conditions.

**CO3:** Understand techniques of establishing cell suspension cultures

**CO4:** Carry out plant tissue culture experiments with different explants.



**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6063(P)**  
**Plant Biotechnology-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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.

**Books Recommended:**

1. Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
2. Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
3. Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.
4. Smith, RH. (2000) Plant tissue culture: techniques and experiments, Gulf professional publishing

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6064**  
**Bioprocess Engineering-II**  
**with training (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: 2023-24**

**Course Code: BBTM-6064**

**Bioprocess Engineering-II  
with training (Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting atleast one question from each section. The fifth question may be attempted from any section. Each question carries 6 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 (Temperature and pH control system, flow measurement, foam sensing, pressure control and D.O. probes, operation and agitation and its kinetics.

**Unit-III**

Downstream 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, basics concept of super critical fluid extraction and whole broth processing.

**Unit-IV**

Effluent treatment- Primary, secondary and tertiary treatment, aerobic and anaerobic slug treatment process, fermentation economics.

**Books Recommended:**

1.Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 2<sup>nd</sup> Edition., Pergamon Press, Oxford.

2. Young, MY. (2000). Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.
3. Young, MY. (1996). Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.
4. Bailary, JE. and Ollis, DF. (1986). Biochemical Engineering Fundamentals, McGraw Hills, New York.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6064(P)**  
**Bioprocess Engineering-II**  
**with 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: 2023-24**  
**Course Code: BBTM-6064(P)**  
**Bioprocess Engineering-II**  
**with training (Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**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: 2023-24**

**Course Code: BBTM-6085**

**Chemistry-III**

**(Theory)**

**COURSE OUTCOME:**

Students will be able to

**CO1:** understand the various thermodynamic properties and laws of Thermodynamics, and acquire knowledge about the various thermodynamic terms like enthalpy of formation, enthalpy of ionisation, entropy, internal energy. Calculate entropy change for reversible and irreversible processes under isothermal and non-isothermal conditions and also absolute entropies of substances.

**CO2:** acquire the knowledge of structure and intermolecular forces present between solids, liquids and gases.

**CO3:** Understand the concept of reaction rates and determine the rate law from initial rate data. Determine the order of reaction with respect to each reactant, the overall order of reaction, the rate constant with units. Learn about the Catalysis, hydrogenation Catalysis

**CO4:** understand the concept of Electrochemistry and various terms related to it like resistance, conductance, specific resistance, cell constant, EMF and determine the transference number of ions using Hittorf and moving boundary methods.

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2023-24**

**Course Code: BTM-6085**

**Chemistry-III**

**(Theory)**

**Time: 3 Hrs.**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setters:**

Eight questions of equal marks (6 each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section

**UNIT-I**

**CHEMICAL THERMODYNAMICS:**

Objectives and limitations of Chemical Thermodynamics, State functions, thermodynamic equilibrium, work, heat, internal energy, enthalpy. First Law of Thermodynamics : First law of thermodynamics for open, closed and isolated systems. Reversible isothermal and adiabatic expansion/compression of an ideal gas. Irreversible isothermal and adiabatic expansion. Enthalpy change and its measurement, standard heats of formation and absolute enthalpies. Kirchoff's equation. Second and Third Law: Various statements of the second law of thermodynamics. Efficiency of a cyclic process (Carnot's cycle). Entropy. Entropy changes of an ideal gas with changes in P, V, and T. Free energy and work functions. Gibbs-Helmholtz Equation. Criteria of spontaneity in terms of changes in free energy. Third law of thermodynamics: Absolute entropies. Thermodynamics of Simple Mixtures: Partial molar quantities and their significance. Chemical potential and its variation with T and P. Fugacity function and its physical significance. Concept of activity and activity coefficient.

**UNIT-II**

**SOLUTIONS:**

Ideal and non-ideal solutions, method of expression concentrations of solution, activity and activity coefficients, dilute solution, Osmotic pressure, its law and measurements, Elevation of boiling point and depression of freezing points. Chemical Equilibrium : General characteristics



of chemical equilibrium, thermodynamic derivation of the law of chemical equilibrium, Van'tHoff reaction isotherm. Relation between  $K_p$ ,  $K_c$  and  $K_x$ . Temperature dependence of equilibrium constant Van't Hoff equation, homogeneous & heterogeneous equilibria, Le Chatelier's principle.

### **UNIT-III CHEMICAL KINETICS AND CATALYSIS:**

Scope, rate of reaction, influencing factors such as concentration, temperature, pressure, solvent etc. theories of chemical kinetics. Arrhenius equation, concept of activation energy. Rates of reactions, rate constant, order and molecularity of reactions. Chemical Kinetics: Differential rate law and integrated rate expressions for zero, first, second and third order reactions. Half-life time of a reaction. Methods for determining order of reaction. Effect of temperature on reaction rate and the concept of activation energy. Reaction mechanism. Steady state hypothesis. Catalysis : Homogeneous catalysis, Acid-base catalysis and enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis. Unimolecular surface reactions.

### **UNIT-IV**

#### **ELECTRO-CHEMISTRY:**

Specific conductance, molar conductance and their dependence on electrolyte concentration. Ionic Equilibria and conductance, Essential postulates of the Debye-Huckel theory of strong electrolytes. Mean ionic activity coefficient and ionic strength. Transport number and its relation to ionic conductance and ionic mobility. Conductometric titrations. pH scale. Buffer solutions, salt hydrolysis. Acid-base indicators.

#### **Books Recommended:**

1. Physical Chemistry by Samuel H, Carl P. Putton; 4<sup>th</sup> Edition, Americ Inc. Co.
2. Physical Chemistry by Glasstone, 2<sup>nd</sup> Edition, The Macmillian Press Ltd.
3. Kinetic and Mechanism by Frost A and Pearson R.G, 3<sup>rd</sup> Edition, Wiley Eastern Pvt.Ltd.
4. Chemical Kinetic by K.J. Laidler, Harper and Row.
5. Physical Chemistry by Glberg W. Castellian Addison: 3<sup>rd</sup> Revised Edition Wesley publishing Comp
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Ed. V and VI. Wiley Inter-science

**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2023-24**

**Course Code: BBTM-6085 (P)**

**Chemistry-III**

**(Practical)**

**Time: 3 Hrs**

**Practical Marks: 18**

**Course outcome:**

Students will be able to

**CO1:** know the principle and mechanism of Conductometric titrations and polarimetric experiments

**CO2:** determine the heat of neutralization and Heat of solution calorimetrically

**CO3:** verify Beer Lambert Law for different solutions.

**CO4:** determine the pH of the solution and analyze optical active substances

## Bachelor of Science (Bio-Technology) Semester-VI

Session: 2023-24

Course Code: BBTM-6085 (P)

Chemistry-III

(Practical)

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

### Experiments:

1. Calorimetry:
  - a) Determination of Heat of neutralization
    - (i) Strong acid-strong base
    - (ii) Weak acid-strong base.
  - b) Determination of Heat of solution of KCl, NH<sub>4</sub>Cl, KNO<sub>3</sub>
2. Conductometry:
  - a) Determination of cell constant.
  - b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).
  - c) Precipitation titration of Na<sub>2</sub>SO<sub>4</sub> vs. BaCl<sub>2</sub>.
  - d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH<sub>3</sub>COOH.
3. Photometry.

Verification of Lambert beer's law for solution of CoCl<sub>2</sub>·H<sub>2</sub>O (in water) and K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> (in water)

4.
  - a) pH of buffer solution
  - b) Acid base titration HCl vs. NaOH.
  - c) Determination of ionization constant of a weak acid (CH<sub>3</sub>COOH)
5. Determine composition of HCl and CH<sub>3</sub>COOH in the given solution pH metrically.
6. Polarimetry: Determine the %age composition of an optically active solution.

### Books Recommended:

1. Experiments in General Chemistry, C.N.R. Rao and U.C. Aggarwal, East-West Press.
2. Experiments in Physical Chemistry, R.C. Das and B. Behra, Tata McGraw Hill.
3. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.
4. Advanced Experimental Chemistry, Vol. I, Physical, J.N. Guru and R. Kapoor, S. Chand and Co.
5. Selected Experiments in Physical Chemistry, N.G. Mukherjee, J.N. Ghosh and Sons.
6. Experiments Physical Chemistry, J.C. Ghosh, Bharati Bhavan.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BTM-6066**  
**Biochemical and Biophysical Techniques-II**  
**(Theory)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Illustrate the working principles of electrophoresis technique.

**CO2:** Learn applications of electrophoresis techniques.

**CO3:** Understand the concepts of spectrophotometry and applications of different types of spectrophotometry.

**CO4:** To understand radioisotopy and instruments used for detecting and measuring radiations.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6066**  
**Biochemical and Biophysical Techniques-II**  
**(Theory)**

**Time: 3 Hours**

**Max. Marks: 60**

**Theory: 30**

**Practical: 18**

**CA: 12**

**Instructions for the Paper Setter**

Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting atleast one question from each section. The fifth question may be attempted from any section. Each question carries 6 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. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman.
5. Mousumi, D. (2011). Tools and techniques of biotechnology. Jaipur, India: Pointer Publisher.

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6066(P)**  
**Biochemical and Biophysical Techniques-II**  
**(Practical)**

**COURSE OUTCOMES:**

After passing this course the student will be able to:

**CO1:** Prepare standard curve of protein

**CO2:** Prepare standard curve of DNA

**CO3:** Separate biomolecules by Native PAGE

**CO4:** Separate bio-molecules by IEF

**Bachelor of Science (Bio-Technology) Semester-VI**  
**Session: 2023-24**  
**Course Code: BBTM-6066(P)**  
**Biochemical and Biophysical Techniques-II**  
**(Practical)**

**Time: 3 Hrs.**

**Practical Marks: 18**

**Instructions for the practical Examiner:**

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

**Experiments:**

1. Preparation of standard curve of protein
2. 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. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.



**Bachelor of Science (Bio-Technology) Semester-VI**

**Session: 2023-24**

**Course Code: BBTS-6067**

**Term Paper**

**(Seminar)**

**Time: 3 Hrs.**

**Max. Marks: 20**

**Instructions:**

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