FACULTY OF LIFE SCIENCES

SYLLABUS

Of

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

(Under Credit Based Evaluation Grading 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

Semester-I

Course No.	Course Title	Course Type	Credits		Total Credits	L	P	CA	Marks
			L	P					
BBTL -1421 BBTL -1031 BBTL -1431	Punjabi (Compulsory) [1]Basic Punjabi [2]Punjab History and Culture	C	4	0	4	80	-	20	100
BBTL-1102	Communication Skills in English	C	4	0	4	80	-	20	100
BBTL-1483	Cell Biology	C	3	0	3	40	-	10	50
BBTL-1074	Botany-I	C	3	0	3	40	-	10	50
BBTL-1085	Biochemistry-I	C	3	0	3	40	-	10	50
BBTL-1346	General Microbiology-I	C	3	0	3	40	-	10	50
BBTL-1087	Chemistry-I	C	3	0	3	40	-	10	50
BBTP-1488	Lab in Cell Biology	C	0	1.5	1.5	-	20	5	25
BBTP-1079	Lab in Botany-I	C	0	1.5	1.5	-	20	5	25
BBTP-1080	Lab in Biochemistry-I	C	0	1.5	1.5	-	20	5	25
BBTP-1341	Lab in General Microbiology-I	C	0	1.5	1.5	-	20	5	25
BBTP-1082	Lab in Chemistry-I	C	0	1.5	1.5	-	20	5	25
AECD-1161	[*]Drug Abuse: Problem Management and Prevention (Compulsory)	AC	2	0	2	40	-	10	50
SECF-1492	[*]Foundation Course	AC	2	-	2	20		5	25
Total Credits					30.5				

[1] Special Course in lieu of Punjabi (Compulsory)

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

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

C-Compulsory

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

Semester-II

Course No.	Course Title	Course Type	Credits		Total Credits	L	P	CA	Marks
			L	P					
BBTL -2421 BBTL -2031 BBTL -2431	Punjabi (Compulsory) [1]Basic Punjabi [2]Punjab History and Culture	C	4	0	4	80	-	20	100
BBTM-2102	Communication Skills in English	C	3	1	4	50	30	20	100
BBTL-2333	Biostatistics	C	3	0	3	40	-	10	50
BBTL-2484	Zoology-I	C	3	0	3	40	-	10	50
BBTL-2065	Genetics	C	3	0	3	40	-	10	50
BBTL-2086	Biochemistry-II	C	3	0	3	40	-	10	50
BBTL-2347	General Microbiology-II	C	3	0	3	40	-	10	50
BBTP-2488	Lab in Zoology-I	C	0	1.5	1.5	-	20	5	25
BBTP-2069	Lab in Genetics	C	0	1.5	1.5	-	20	5	25
BBTP-2080	Lab in Biochemistry-II	C	0	1.5	1.5	-	20	5	25
BBTP-2341	Lab in General Microbiology-II	C	0	1.5	1.5	-	20	5	25
SECM-2492	*Moral Education	AC	-	-	2	20	-	5	25
Total Credits					29				

[1] Special Course in lieu of Punjabi (Compulsory)

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

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

C-Compulsory

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

Bachelor of Science (Bio-Technology) Semester-III							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
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	-
Total			**360**				

***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

Bachelor of Science (Bio-Technology) Semester-IV							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
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	-
Total			**380**				

***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

Bachelor of Science (Bio-Technology) Semester-V							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
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
SECJ-5551	*Job Readiness course	AC	25	20	-	5	-
Total			**360**				

***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

Bachelor of Science (Bio-Technology) Semester-VI							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
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	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-6087	Term Paper	C	20	-	20	-	-
Total			**380**				

C-Compulsory

B.Sc. Bio-Technology Semester-I

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTL-1085
Biochemistry-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Gain basic knowledge about water and pH.

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

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

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTL-1085
Biochemistry-I
(Theory)

Time: 3 Hours

Theory: 40
CA: 10

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Books Recommended:

1. Voet, D.,Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5th Edition, Wiley.

2. Stryer, L. (2015). Biochemistry, 8th Edition, W.H. Freeman and Company, New York

3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2019). Biochemistry, 9th Edition, Freeman.

4. Mathew, C.K., Van, K.E. and Anthern, K.G. (2012). Biochemistry 4th Edition, Addison Wesley.

5. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7th Edition, CBS Publishers and Distributors, New Delhi.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTP-1080
Lab in Biochemistry-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform Beer Lamberts Law

CO2: Determine pKa value while performing practical

CO3: Estimate carbohydrates in the given sample

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTP-1080
Lab in Biochemistry-I
(Practical)

Time: 3 Hrs. **Practical Marks: 20**
CA: 05

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

Experiments:

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

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTL-1346
General Microbiology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Study the structure of bacteria cell and bacterial classification

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

CO4: To learn different types of microscopy techniques.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTL-1346
General Microbiology-I
(Theory)

Time: 3 Hours

Theory: 40
CA: 10

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

Unit-I

Introduction to microbiology- Historical perspective and important discoveries related to microbiology. Relationship between microbiology and biotechnology- The microbial biotechnology. General features-Bacteria, Fungi, Neurospora, Yeast and Viruses. Microbes in extreme environments- the thermophiles, halophiles, acidophiles, psychrophiles and alkalophiles.

Unit-II

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

Unit-III

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

Unit-IV

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

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Stanier, R.Y. (1999). General microbiology, MacMillan Press, London.
3. Tortora, G.J., Funke, B.R. and Case, C.L. (2015). Microbiology: An introduction, 12th Edition, Pearson College Div.
4. Willey, J., Sherwood, L. And Wooverton, C. J. (2017). Prescott's Microbiology, 10th Edition, McGraw-Hill Education/ Asia
5. Pelczar, M.J., Chan, E.C.S. and Krieg, N.R. (2010). Microbiology: An application-based approach, Tata McGraw Hill.
6. Purohit, S.S. (2006). Microbiology: Fundamentals and Applications, 7th Edition, Agrobios (India).

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTP-1341
Lab in General Microbiology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand sterilization techniques of different types of materials.

CO2: Learn methods of isolation and identification of bacteria

CO3: Learn methods of detection of microbes.

CO4: Understand preservation methods of microbes.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2023-24
Course Code: BBTP-1341
Lab in General Microbiology-I
(Practical)

Time: 3 Hrs. **Practical Marks: 20**

CA: 05

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

Books Recommended:

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

B.Sc. Bio-Technology Semester-II

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTL-2065
Genetics
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand Mendelian and Neo-mendelian genetics along with the study of phenomenon of dominance, laws of segregation, independent assortment of genes

CO2: Develop an understanding of the principles and mechanisms of linkage and crossing over.

CO3: To learn various types of mutations their significance and practical applications along with basic microbial genetics

CO4: Understand the organization of chromosomes and concept of human genetics

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTL-2065
Genetics
(Theory)

Time: 3 Hours

Theory: 40
CA: 10

Instructions for the Paper Setter

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

Unit - I

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

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

Unit – II

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

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

Unit – III

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

Basic Microbial Genetics: Conjugation, transduction, transformation

Unit – IV

Organization of Chromosomes: The structure of prokaryotic and eukaryotic chromosome, centromere, and telomere structure, euchromatin and heterochromatin, Special chromosomes: Polytene chromosomes and lampbrush chromosomes, satellite DNA, supercoiling of DNA.

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

Books Recommended:

1. Gupta, P.K. (2018). Genetics, 5th Revised Edition, Rastogi Publications.
2. Hartl, D.L., Cochrane, B. (2017). Genetics: Analysis of Genes & Genomes 9th Edition. Jones & Bartlett Publishers.
3. Brooker, R.J. (2017). Genetics: Analysis and Principles, McGraw-Hill Education.
4. Pierce, B. (2016). Genetics: A conceptual approach, 6th Edition, WH Freeman.
5. Snustad and Simmons (2015). Principles of Genetics, 7th Edition, John Wiley & Sons.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTP-2069
Lab in Genetics
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand Mendelian laws.

CO2: Solve paternity disputes.

CO3: Demonstrate segregation in preserved material.

CO4: Study polytene chromosomes and dermatoglyphics.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTP-2069
Genetics
(Practical)

Time: 3 Hrs. **Practical Marks: 20**
CA: 05

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

Experiments:

1. Demonstration of Law of segregation and Independent assortment (use of colored beads, capsules etc.).

2. Numerical problems on Mendelism and on modified F2 ratios.

3. Numerical problems on paternity disputes (Blood groups)

4. Segregation demonstration in preserved material

5. Study of polytene chromosomes from permanent slides.

6. Dermatographics: Palm print taking and fingertip patterns.

7. Preparation and study of mitosis slides from onion root tips by squash method.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTL-2086
Biochemistry – II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Familiarize with biomolecules and related metabolic pathways

CO2: Know the importance and metabolic role of ATP and other energy rich metabolites

CO3: Familiarize with enzymes and related mechanism

CO4: Get acquainted with the concept of enzyme kinetics.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTL-2086
Biochemistry – II
(Theory)

Time: 3 Hours

Theory: 40
CA: 10

Instructions for the Paper Setters:

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

Unit-I

Introduction to metabolism, catabolism, anabolism, Laws of thermodynamics and living system, free energy change and direction of metabolism, Characteristics of metabolic pathways, Compartmentation and inter-organ metabolism, Regulation and evolution of metabolic pathways

Unit-II

ATP: Structure, free energy change, energy coupling with ATP (Creatinine phosphokinase, NDP kinase, Adenylate kinase), metabolic roles of ATP; Experimental methods for studying metabolism, energy rich metabolites, biological oxidation – reduction reactions

Unit-III

Introduction to enzymes: Nomenclature, classification and characteristics of enzymes, cofactors, co-enzyme and prosthetic group, Mechanism of enzyme action: Nature of active site, enzyme substrate complex, Factors responsible for catalytic efficiency of enzymes., covalent catalysis, acid base catalysis, strain and distortion theory, induced fit hypothesis.

Unit-IV

Enzyme Kinetics: A brief overview of enzyme energetics, Michaelis Menten equation. Derivation of Michaelis Menten equation and determination of Km and Vmax values

Enzyme inhibition: Reversible and irreversible inhibition, Kinetics of competitive, uncompetitive, and non-competitive inhibition. Regulation of enzyme activity, isozymes, and their importance

Books Recommended:

1. Voet, D., Voet, J.G. and Prait, C.W. (2018). Principles of Biochemistry, 5th Edition, Wiley.

2. Stryer, L. (2015). Biochemistry, 8th Edition, W.H. Freeman and Company, New York

3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2011). Biochemistry, 7th Edition, Freeman.

4. Nelson, D.L. and Cox, M.M. (2013). Principles of Biochemistry, 7th Edition, Freeman

5. Mathew, C.K., Van, K.E. and Anthern, K.G. (2012). Biochemistry 4th Edition, Addison Wesley.

6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7th Edition, CBS Publishers and Distributors, New Delhi.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTP-2080
Lab in Biochemistry – II
(Practical)

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

CO1: Estimate the enzyme activity.

CO2: Determine the effect of physical parameters on enzyme activity.

CO3: Determine Km (Michaelis constant) for enzymes

CO4: Perform and analyze competitive and non-competitive inhibition in enzymes

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTP-2080
Lab in Biochemistry – II
(Practical)

Time: 3 Hrs. **Practical Marks: 20**

CA:05

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. Estimation of Alpha-amylase activity from saliva.
2. Assay of acid phosphatase activity.
3. Effect of temperature on enzyme activity.
4. Effect of pH on enzyme activity
5. Determination of Km for acid phosphatase.
6. Competitive and non-competitive inhibition.

Books Recommended:

1. Plummer D.T. (2017) An Introduction to Practical Biochemistry, 3rd Edition Tata McGraw Hill Education.
2. Sawhney, S.K. and Randhir singh (2001). Introductory Practical Biochemistry, Narosa Publishing House.
3. Wilson, K. and Walker, J. (2018). Principles and Techniques of Biochemistry, 8thEdition, McGraw Hill Education.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTL-2347
General Microbiology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Know the concept of microbial growth in batch and continuous system.

CO2: Know the basics of viruses and its types.

CO3: Have the basic mechanism of action, diagnosis, and treatment for different viral, bacterial, and fungal diseases.

CO4: Acquire the knowledge of industrial microbiology and to understand the role of microbes in environment.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTL-2347
General Microbiology-II
(Theory)

Time: 3 Hours

Theory: 40
CA: 10

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

Pathogenic microorganisms- Factors contributing towards microbial pathogenicity (adhesion, invasiveness and toxigenicity), Natural resistance and Non-specific defense mechanism against microorganisms. Introduction, mechanism of action, diagnosis, and treatment for viral diseases- Influenza, AIDS, and hepatitis. Bacterial diseases-Diphtheria, Tuberculosis, Typhoid, *Streptococcus*, *Klebsiella* infection. Fungal diseases-Aspergillosis and Candidiasis.

UNIT-IV

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

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition, Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An Introduction: 5th Edition, The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, London.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel, H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Jain, S.K. (1999). Prescott and Dunn's Industrial Microbiology 4th Edition, CBS Publishers & Distributors.
7. Chander, M. and Puri, P (2008). A Concise Course in Microbiology, Krishna Brothers Publishers, Old Railway Road, Jalandhar.
8. Postgate. J. (2000). Microbes & Man, 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R. (2001). Microbiology: An Introduction, Benjamin Cummings.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTP-2341
Lab in General Microbiology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Count microorganisms by different methods using microbiological practices

CO2: Know the importance of personal hygiene.

CO3: Identify different fungus by staining

CO4: Study the growth curve of different microorganisms

Bachelor of Science (Bio-Technology) Semester-II
Session: 2023-24
Course Code: BBTP-2341
Lab in General Microbiology-II
(Practical)

Time: 3 Hrs. **Practical Marks: 20**
CA: 05

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

Experiments:

1. Enumeration of microorganism. Total vs viable counts.

2. Personal hygiene-Microbes from hands, tooth-scum and other body parts.

3. Monoauxic and diauxic growth curve of micro-organisms.

4. Identification of fungus by and lactophenol staining.

5. Identification of formation of germ tube by *Candida albicans*.

6.Visualization of *Streptococcus*

7.Waste water management test

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (2014). Microbiology: A Laboratory Manual 10th Edition, Harlow, Addition-Wesley.

2. Sambrook, J. and Russel, D.W. (2012). Molecular Cloning: A laboratory manual 4th Edition, Cold Spring Harbor Laboratory Press, New York.

3. Dubey, R.C. and Maheshwari (2012) Practical Microbiology 5th Edition, S. Chand and company Ltd, New Delhi

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, 8th 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 Esssential Immunology, Wiley Blackwell Publishers.
3. Paul, W.E. (2012). Fundamental Immunology, 7th 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, 8th 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. 3rd Edition, Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4th Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4th Edition, Wiley Blackwell.

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, 5th Edition, Wiley.

2. Stryer, L. (2015). Biochemistry, 8th Edition, W.H. Freeman and Company, New York

3. Berg, J.M., Tymoczko, J. L. And Stryer, L. (2011). Biochemistry, 7th Edition, Freeman.

4. Nelson, D.L. and Cox, M.M. (2013). Principles of Biochemistry, 7th Edition, Freeman

5. Mathew, C.K., Van, K.E. and Anthern, K.G. (2012). Biochemistry 4th Edition, Addison Wesley.

6. Lehninger, A.L., Nelson, D.L. and Lox, M.M. (2017). Principles of Biochemistry, 7th Edition, CBS Publishers and Distributors, New Delhi.

Bachelor of Science (Bio-Technology) 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. 3rd Edition,Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4th Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4th 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, 11th 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, 8th Edition, Wiley Blackwell.

6. Strachan, T. and Read, A. (2010). Human Molecular Genetics, Garland Science

7. Pierce, B. (2016). Genetics: A conceptual approach, 6th 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, 8th Edition, Wiley Blackwell

2. Sambrook J. and Green M. R. (2013). Molecular Cloning: A Laboratory Manual, 4th Edition, CSHL.

3. Brown T.A (2017). Genomes, 3rd Edition, Garland Science.

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, 2nd edition, CRC Press.

7.

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, 9th Edition, Elsevier.

2. Benjamni, E., Coico, R. and Sunshine, G. (2015). Immunology: A short course, 7th Edition, New York, Wiley- Wiley-Blackwell.

3. Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I.M. (2017). Roitt's Esssential Immunology, Wiley Blackwell Publishers.

4. Roitt, I., Brostoff, J. and Male, D. (2001). Immunology, 6th 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, 2nd Edition, Garland Science.

7. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). Kuby Immunology, 8th 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 2nd Edition, F.A Davis Company, Philadelphia.

2. Celis, J.E., Hunter, T. and Carter, N. (2005). Cell Biology: A laboratory handbook. 3rd Edition,Vol-III, Academic Press, U.K.

3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4th 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 academia (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, 4th 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, 7th 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, 4th Edition, Royal Society of Chemistry).

3. SriLakshmi B. (2018). Food science, 7th Edition, New Age International Publishers, India.

4. Jay J.M., Loessner M.J. and Golden D.A. (2006). Modern Food Microbiology, 7th Edition, Springer India.

5. Sivasankar B. (2004). Food processing and preservation, 1st Edition, Prentice-Hall of India Pvt. Ltd, New Delhi.

6. Michael P. Doyle, Larry R. Beuchat (2007). Food Microbiology: Fundamentals and Frontiers, 3rd 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 Penalities, 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, 7th Edition, McGraw Hill Education, New Delhi.

2. Sinha P.K. (2010). Fundamental of Computers, 8th 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, 3rd 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: 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.

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 λ 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: $CaCl_2$, 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, 8th Edition, Wiley Blackwell.

2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4th Edition, CSHL.

3. Brown TA. (2017) Genomes, 4th 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 $CaCl_2$ method.

Books Recommended:

1.Primrose, SB and Twyman, R. (2013). Principles of Gene Manipulation and genomics, 8th Edition, Wiley Blackwell.

2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4th Edition, CSHL.

3.Brown TA. (2017) Genomes, 4th 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 7th 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. 7th 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.

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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 2nd 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: BBTM-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, 2nd 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.

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, 8th Edition, Wiley Blackwell.

2. Sambrook, J. and Green M.R. (2012) Molecular Cloning: A Laboratory Manual, 4th Edition, CSHL.

3. Brown, T.A. (2017) Genomes, 4th 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, 8th Edition, Wiley Blackwell.

2. Sambrook, J and Green MR (2012) Molecular Cloning: A Laboratory Manual, 4th Edition, CSHL.

3.Brown TA. (2017) Genomes, 4th 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, 2nd Edition, Academic Press, New York.

4. Freshney, RT. (2016), Culture of Animal Cells 7th 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 IC50 value of a drug using MTT assay

Book Recommended:

1. Freshney, RT. (2016), Culture of Animal Cells. 7th 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: BBTM-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
(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
(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 2nd 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
(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
(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-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.