FACULTY OF LIFE SCIENCES

SYLLABUS

Of

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

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

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

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

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

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

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

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

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

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

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2025-26

Semester-V

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL 5061	rDNA Technology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5062	Animal Biotechnology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5063	Plant Biotechnology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5064	Bioprocess Engineering-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-5065	Biochemical and Biophysical Techniques-I	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-5066	Industrial Biotechnology-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTP-5067	Lab in rDNA Technology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5068	Lab in Animal Biotechnology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5069	Lab in Plant Biotechnology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5060	Lab in Bioprocess Engineering-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5061	Lab in Biochemical and Biophysical Techniques-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-5062	Lab in Industrial Biotechnology-II	C	0-0-2	0-0-1	1	-	20	5	25
SECJ-5551	*Job readiness Course	AC	2-0-0	2-0-0	2	40	-	10	50
				Total Credits	24				

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

C-Compulsory
VAC: Value Added Course

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2025-26

Semester-VI

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL-6061	rDNA Technology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6062	Animal Biotechnology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6063	Plant Biotechnology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6064	Bioprocess Engineering-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-6085	Chemistry-III	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-6066	Biochemical and Biophysical Techniques-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTP-6067	Lab in rDNA Technology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6068	Lab in Animal Biotechnology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6069	Lab in Plant Biotechnology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6060	Lab in Bioprocess Engineering-II (Industrial Training)	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6081	Lab in Chemistry-III	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-6062	Lab in Biochemical and Biophysical Techniques-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTS-6063	Term Paper	C	0-0-2	0-0-1	1	-	20	5	25
				Total Credits	23				

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

B.Sc. Bio-Technology Semester-V

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

CO3: Apply blotting and transformation techniques in molecular biology.

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

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA:15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

Unit-I

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

Unit-II

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

Unit-III

Southern and Northern blotting, Hybridization, Merits and demerits of nitrocellulose and nylon membranes (N and N+). Methods of Transformation: CaCl2, electroporation, transfection, microprojectile.

Unit-IV

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

Books Recommended:

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

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

CO4: Study primary culture and establishment of cell line culture

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Books Recommended

1.Freshney, R.I (2015) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. 7th Edition, John Wiley and Sons, New Delhi.

2.Animal Cell Culture: Essential Methods. Edited by John M. Davis. John Wiley & Sons, Ltd. UK. 2011

3.Cell Biology: A Laboratory Handbook. Volume 1-4, 3rd Edition. Edited by Julio E. Celis, Nigel Carter, Kai

4. Simons, J. Victor Small, Tony Hunter and David Shotton. Academic Press. USA, 2005

5.Butler, M. (2004). Animal Cell Culture and Technology, 2nd Ed., BIOS Scientific Publishers, Taylor & Francis group, London and New York.

6. Basic Cell Culture: A Practical Approach, 2nd ed.Edited by John Davis Oxford University Press, Oxford and New York. 2002

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

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

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

Unit-I

Cellular totipotency; differentiation, dedifferentiation and redifferentiation of cells; tissue competency; plant-explant-plant concept.
Plant tissue culture lab: Layout and organization, infrastructure, equipments and instruments.
Sterilization methods for lab, glassware, tools, culture media and plant materials.

Unit-II

Culture Media: Nutritional requirements for plant tissue culture; types of media and role of different components; preparation of culture media.
Physiological functions and biosynthesis of major plant growth regulators such as auxins, cytokinins, gibberellins and abscisic acid.

Unit-III

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

Unit IV

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

Books Recommended:

1.Plant Tissue Culture: An Introductory Text by Sant Saran Bhojwani, Prem Kumar Dantu 2013 Publisher: Springer India
2.Introduction to Plant Tissue Culture. M. K. Razdan • 2019 ISBN: 9788120417939 Publisher: OXFORD & IBH PUBL
3.Plant Cell Culture: Essential Methods. Michael R. Davey, Paul Anthony • 2010 Publisher: Wiley

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Understand microbial growth kinetics

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

CO4: To study about sterilization of fermenter.

.

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

Time: 3 Hours **Max. Marks: 75**
L-T-P: 3-0-0 **Theory: 60**
CA: 15

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

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

Books Recommended:

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

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

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Gain fundamental knowledge about centrifugation.

CO2: Understand the different types of chromatography techniques.

CO3: Learn basic principles of spectroscopy

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

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

Time: 3 Hours **Max. Marks: 50**
Theory: 40
CA:10

L-T-P: 2-0-0

Instructions for the Paper Setters:
Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 08 marks.

Unit-I

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

Unit - II

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

Unit III

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

Unit IV

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

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
3. Friefelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W. H. Freeman, and Co.
4. Plummer D (2006) An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co., New Delhi.
5. Wilson K and Walker J (2010) Principles and Techniques of Practical Biochemistry, Cambridge University Press, UK
6. Boye R (2006) Modern Experimental Biochemistry, Pearson Education, Asia, New
7. Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Pub. House, New Delhi.

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

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

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

Time: 3 Hours **Max. Marks: 50**
Theory: 40
CA:10

L-T-P: 2-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 08 marks.

Unit-I

Antibiotics production: Penicillin and Streptomycin. Enzymes production: amylases and cellulases, solvent production: Acetone, butanol and ethanol. Vermicomposting, Microbial inoculants and production of bacterial biofertilizers, Biocontrol agent and their significance.

Unit-II

Fermented foods: Sauerkraut and pickles, Biotransformation, organic acids: production of citric Acid and acetic acid, microbial production of vitamins: vitamin-B12 and vitamin-C, amino acids: Glutamic acid and lysine, single cell protein: spirulina production, alcohols: wine and beer, and mycotoxins (Aflatoxins).

Unit-III

Fuel Biotechnology, transgenic crops (BT cotton and maize) and their potentials in agro industry, soil treatment with microbes, Mycorrhizal fungi, Biogas production, Biodegradation of xenobiotic compound.

Unit-IV

BNF and its significance, diazotrophes and their characterization, Microbial association and their interaction with plants, nitrogen cycle and role of Nitrogen fixing microbes in sustainable agriculture.

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5067
Course Title: Lab in rDNA Technology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Quantify and assess the purity of DNA using spectrophotometry

CO3: Perform agarose gel electrophoresis and restriction enzyme digestion.

CO4: Demonstrate the Southern blotting technique for DNA analysis.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5067
Course Title: Lab in rDNA Technology-I
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

1. Growing of *E. coli* bacterial culture.
2. Isolation of genomic DNA from bacteria.
3. Spectrophotometric quantification of DNA and determination of purity.
4. Agarose Gel Electrophoresis.
5. Southern Blotting.

Books Recommended:

1.S.B. Primrose and R.M. Twyman; Principles of Gene Manipulation. 2006.
2.J. Sambrook and Michael R. Green; Molecular Cloning: A Laboratory Manual, (Fourth Edition), CSHL, 2012.
3.Brown TA, Genomes, 3rd ed. Garland Science 2006

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5068
Course Title: Lab in Animal Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

CO3: Separate serum from blood samples.

CO4: Isolate and culture macrophages from blood samples.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5068
Course Title: Lab in Animal Biotechnology-I
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

1.Sterilization techniques: Theory and practical-Glassware sterilization, media sterilization, laboratory sterilization

2.Sources of contamination and decontamination measures.

3. Preparation of Hanks Balanced salt solution.

4. Preparation of Minimal Essential Growth medium.

5. Separation of Serum from blood.

6. Isolation of macrophages from blood for culturing.

Book Recommended:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2024-25
Course Code: BBTP-5069
Course Title: Lab in Plant Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Learn sterilization process required in plant tissue culture.

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

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5069
Course Title: Lab in Plant Biotechnology-I
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5060
Course Title: Lab in Bioprocess Engineering-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

CO4: Perform assay of enzyme produced using fermentation.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5060
Course Title: Lab in Bioprocess Engineering-I
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Book Recommended:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5061
Course Title: Lab in Biochemical and Biophysical Techniques-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Separate biomolecules using paper and thin layer chromatography.

CO3: Separate proteins using ion-exchange chromatography

CO4: Apply affinity chromatography for purification of specific proteins.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5061
Course Title: Lab in Biochemical and Biophysical Techniques-I
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5062
Course Title: Lab in Industrial Biotechnology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Screen cellulose-producing microorganisms from environmental samples.

CO2: Evaluate the additive and synergistic effects of antibiotics on microbial growth.

CO3: Determine the minimum inhibitory concentration (MIC) of antibiotics.

CO4: Assess microbial quality of milk and identify microbes from spoiled food samples.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2025-26
Course Code: BBTP-5062
Course Title: Lab in Industrial Biotechnology-II
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Books Recommended:

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

B.Sc. Bio-Technology Semester-VI

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

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

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

UNIT-I

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

UNIT-II

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

UNIT-III

Principles and applications of PCR, Fundamental concepts and applications of microarray.

UNIT-IV

DNA Sequencing: Sanger-Coulson method (chain terminating nucleotides), Maxam Gilbert method (chemical degradation of DNA), Changing genes: site directed mutagenesis, cassette mutagenes, single primer method, PCR methods of site directed mutagenesis, phage display: selection of mutant peptides

Books Recommended:

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

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

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

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

Unit- I

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

Unit- II

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

Unit- III

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

Unit-IV

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

Books Recommended

1.Freshney, R.I (2015) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications. 7th Edition, John Wiley and Sons, New Delhi.
2.Animal Cell Culture: Essential Methods. Edited by John M. Davis. John Wiley & Sons, Ltd. UK. 2011

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

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

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

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

Unit I

Protoplast isolation and culture, viability of protoplasts, protoplast fusion, selection of somatic hybrids and cybrids, applications of somatic cell hybridization.
Cell suspension culture, production of secondary metabolites by plant tissue culture, immobilized plant cell culture and use of bioreactors in secondary metabolite production.
Cryopreservation of germplasm: Short term and long term conservation of plant genetic resources.

Unit II

Organization of genes in plants; promoter and regulatory sequences; reporter genes, marker genes (scorable and selectable).
Genetic transformation of plants by Agrobacterium tumefaciens and A. rhizogenes, natural mode of infection, Ti/Ri plasmids, vir functions, binary and cointegrate vectors, features of transgene integration; use of plant viruses as vectors.

Unit-III

Direct DNA transfer/physical methods of gene transfer in plants: micro-projectile bombardment, electroporation, liposome mediated, calcium phosphate mediated etc; advantages and disadvantages; screening and selection of transformants: PCR and hybridization methods; transgene selection and silencing; generation and maintenance of transgenic plants.

Unit-IV

Applications of Transgenic Plants: Developing insect resistance, bacterial and fungal disease resistance, virus resistance and abiotic stress tolerance in plants. Improving food quality – nutritional enhancement of plants (carbohydrates, seed storage proteins and vitamins). Biopharming: plant cells as factories for production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines.

Books Recommended:

1.Plant Tissue Culture: An Introductory Text By Sant Saran Bhojwani, Prem Kumar Dantu • 2013 Publisher:Springer India
2.Introduction to Plant Tissue Culture M. K. Razdan • 2019 ISBN: 9788120417939 Publisher: OXFORD & IBH PUBL
3.Plant Cell Culture: Essential Methods. Michael R. Davey, Paul Anthony • 2010 Publisher:Wiley

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

CO3: Study about different techniques of downstream processing.

CO4: Learn about effluent treatment and fermentation economics.

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

Time: 3 Hours **Max. Marks: 75**
Theory: 60
CA: 15

L-T-P: 3-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 12 marks.

.

Unit-1

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

Unit-II

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

Unit-III

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

Unit-IV

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

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6085
Course Title: Chemistry-III
(Theory)

COURSE OUTCOMES:

Students will be able to

CO1: Understand and apply the laws of thermodynamics to evaluate energy changes, spontaneity, and equilibrium in chemical systems, including simple mixtures.
CO2: Analyze solution behavior and equilibrium systems using thermodynamic principles, including colligative properties and Le Chatelier's principle.
CO3: Determine reaction rates and mechanisms by applying kinetic theories and rate laws, and explain the role of catalysts in various chemical processes.
CO4: Interpret electrochemical behavior of electrolytes through conductance, ionic equilibria, and buffer systems, and apply this understanding to conductometric titrations and pH analysis.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTL-6085
Course Title: Chemistry-III
(Theory)

Time: 3 Hours **Max. Marks: 50**
Theory: 40
CA: 10

L-T-P: 2-0-0

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

Unit I

CHEMICAL THERMODYNAMICS:

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

Unit II

SOLUTIONS:
Ideal and non- ideal solutions, method of expression concentrations of solution, activity and activity coefficients, dilute solution, Osmotic pressure, its law and measurements, Elevation of boiling point and depression of freezing points. Chemical Equilibrium : General characteristics of chemical equilibrium, thermodynamic derivation of the law of chemical equilibrium, Van't Hoff reaction isotherm. Relation between Kp, Kc and Kx. Temperature dependence of equilibrium constant Van't Hoff equation, homogeneous & heterogreneous equilibria, Le Chetalier's principle.

Unit III

CHEMICAL KINETICS AND CATALYSIS: Scope, rate of reaction, influencing factors such as concentration, temperature, pressure, solvent etc. theories of chemical kinetics. Arrhenius equation, concept of activation energy. Rates of reactions, rate constant, order and molecularity of reactions. Chemical Kinetics: Differential rate law and integrated rate expressions for zero, first,

second and third order reactions. Half-life time of a reaction. Methods for determining order of reaction. Effect of temperature on reaction rate and the concept of activation energy. Reaction mechanism. Steady state hypothesis. Catalysis : Homogeneous catalysis, Acid-base catalysis and enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis. Unimolecular surface reactions.

Unit IV

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

Books Recommended:

1. Physical Chemistry by Peter Atkius 10th edition.

2. Thermodynamics for chemists by Samuel Glasstone 2009

3. Chemical Kinetics by Keith J. Laidler 10th edition.

4. Modern Electrochemistry by John O'M Backris and K.N. Reddy 10th edition.

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

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Describe advanced electrophoresis techniques.

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

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

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

Time: 3 Hours **Max. Marks: 50**
Theory: 40
CA: 10

L-T-P: 2-0-0

Instructions for the Paper Setters: Eight questions of equal marks are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions in all, selecting at least one question from each section. The fifth question may be attempted from any section. Each question carries 08 marks.

UNIT-I

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

UNIT-II

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

UNIT III

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

UNIT-IV

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

Books Recommended:

1.Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2.Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
3.Friefelder, D. (1999). Physical Biochemistry - Application of Biochemistry and Molecular Biology, 2nd Edition, W.H.Freeman and Co.

4.Plummer D (2006) An Introduction to Practical Biochemistry, Tata McGraw Hill Publishing Co., New Delhi.
5.Wilson K and Walker J (2010) Principles and Techniques of Practical Biochemistry, Cambridge University Press, UK
6.Boye R (2006) Modern Experimental Biochemistry, Pearson Education, Asia, New
7.Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry. Narosa Pub. House, New Delhi.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6067
Course Title: Lab in rDNA Technology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate and analyze plasmid DNA.

CO2: Perform restriction digestion using different enzymes.

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

CO4: Perform Polymerase Chain Reaction (PCR).

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6067
Course Title: Lab in rDNA Technology-II
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Books Recommended:

1.S.B. Primrose and R.M. Twyman; Principles of Gene Manipulation. 2006.
2.J. Sambrook and Michael R. Green; Molecular Cloning: A Laboratory Manual, (Fourth Edition), CSHL, 2012.
3.Brown TA, Genomes, 3rd ed. Garland Science 2006

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6068
Course Title: Lab in Animal Biotechnology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate DNA and RNA from blood samples.

CO2: Quantify isolated DNA using spectrophotometry.

CO3: Resolve DNA using agarose gel electrophoresis.

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6068
Course Title: Lab in Animal Biotechnology-II
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6069
Course Title: Lab in Plant Biotechnology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform different steps of micropropagation.

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

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

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6069
Course Title: Lab in Plant Biotechnology-II
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

1. Micropropagation and its different steps.
2. Significance of growth hormones in culture medium.
3. Induction of callus from different explants.
4. To study regeneration of shoots/embryos.
5. Raising of cell suspension cultures.
6. Anther culture, ovary culture and embryo rescue

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6060
Course Title: Lab in Bioprocess Engineering-II (Industrial Training)
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6060
Course Title: Lab in Bioprocess Engineering-II (Industrial Training)
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Note:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6081
Course Title: Lab in Chemistry-III
(Practical)

Course outcomes:
Students will be able to

CO1: Apply principles of calorimetry to determine thermodynamic parameters such as heat of neutralization and heat of solution for various substances.

CO2: Utilize conductometric methods to determine cell constant, specific/equivalent conductance, and perform titrations for precipitation and acid-base reactions.

CO3: Analyze concentration and absorbance relationships using photometric techniques and validate Lambert-Beer's law.

CO4: Measure and interpret pH values to study buffer solutions, determine ionization constants, and analyze acid-base mixtures using pH metry and polarimetry.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6081
Course Title: Lab in Chemistry-III
(Practical)

Time: 3 Hrs. **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instruction for practical examiner: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE office, Kanya Maha Vidyalaya, Jalandhar.

1. Calorimetry:

a) Determination of Heat of neutralization

(i) Strong acid-strong base

(ii) Weak acid-strong base.

b) Determination of Heat of solution of KCl, NH_4Cl, KNO_3

2. Conductometry:

a) Determination of cell constant.

b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).

c) Precipitation titration of Na_2SO_4 vs. $BaCl_2$.

d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH_3COOH.

3. Photometry.

Verification of Lambert beer's law for solution of $CoCl_2H_2O$ (in water) and $K_2Cr_2O_7$ (in water)

4. a) pH of buffer solution

b) Acid base titration HCl vs. NaOH.

c) Determination of ionization constant of a weak acid (CH_3COOH)

5. Determine composition of HCl and CH_3COOH in the given solution pH metrically.

6. Polarimetry: Determine the % age composition of an optically active solution.

Books Recommended :

1. Findlay's Practical Physical Chemistry, 9^{th} Edition, Revised by B.P. Levitt.

2. Experimental Physical Chemistry by RC DAS and B. Behera 9^{th} Edition.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6062
Course Title: Biochemical and Biophysical Techniques-II (Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Analyze DNA samples qualitatively and quantitatively.

CO2: Prepare standard curves for proteins and DNA.

CO3: Cast vertical and horizontal gels for electrophoresis.

CO4: Separate biomolecules using gel electrophoresis techniques.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTP-6062
Course Title: Biochemical and Biophysical Techniques-II
(Practical)

Time: 3 Hours **Max. marks: 25**

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

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

Books Recommended:

1.Upadhyay, A., Upadhyay, K. and Nath N. (2005) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2.Wilson K. and Walker J. (Eds.) (1995). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3.Riley, T. and Tomilson, C. (1987). Principles of Electroanalytical Methods. John Wiley and Sons Ltd., Chichester, England.
4.Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
5.Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.
6.Slater, R.J. (1990). Radioisotopes in Biology- A Practical Approach, Oxford University Press, NY.
7.Wilson, K and Goulding, K.H. (1991). Biologist's Guide to Principles and Techniques of Practical Biochemistry. 3rd., Edward Arnold, London.
8.Sawhney, S.K. and Singh, R. (2001). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
9.Tinoco Kenneth Saur and J.C. Wang. Physical Chemistry: Principles and Applications in Biological Sciences, 3rd edition.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2025-26
Course Code: BBTS-6063
Course Title: Term Paper (Seminar)

Time: 3 Hours **Max. marks: 25**
Practical Marks: 20
CA: 05

L-T-P: 0-0-1

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