FACULTY OF LIFE SCIENCES

SYLLABUS

Of

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

(Under Continuous Evaluation System)

Session: 2024-25

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

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

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

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

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

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

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

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

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

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2024-25

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: 2024-25

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 with training	C	60	30	18	12	3+3
BBTM-6085	Chemistry-III	C	60	30	18	12	3+3
BBTM-6066	Biochemical and Biophysical Techniques-II	C	60	30	18	12	3+3
BBTS-6067	Term Paper	C	20	-	20	-	-
Total			**380**				

C-Compulsory

B.Sc. Bio-Technology Semester-V

Bachelor of Science (Bio-Technology) Semester-V
Session: 2024-25
Course Code: BBTM-5061
Course title: 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: 2024-25
Course Code: BBTM-5061
Course title: 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. Each question carries 6 marks.

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: 2024-25
Course Code: BBTM-5061(P)
Course title: 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: 2024-25
Course Code: BBTM-5061(P)
Course title: 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: 2024-25
Course Code: BBTM-5062
Course title: 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: 2024-25
Course Code: BBTM-5062
Course title: 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. Each question carries 6 marks.

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: 2024-25
Course Code: BBTM-5062 (P)
Course title: 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: 2024-25
Course Code: BBTM-5062 (P)
Course title: 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: 2024-25
Course Code: BBTM-5063
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: 2024-25
Course Code: BBTM-5063
Course title: 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. Each question carries 6 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, 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: 2024-25
Course Code: BBTM-5063(P)
Course title: 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: 2024-25
Course Code: BBTM-5063(P)
Course title: 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: 2024-25
Course Code: BBTM-5064
Course title: Bioprocess Engineering-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Understand microbial growth kinetics

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

CO4: To study about sterilization of fermenter.

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Bachelor of Science (Bio-Technology) Semester-V
Session: 2024-25
Course Code: BBTM-5064
Course title: 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. Each question carries 6 marks.

Unit-I

Introduction: Fundamental principles of chemical Engineering and biochemical engineering. Fourier's Laws of heat transfer, molecular diffusion, diffusion theory, role of diffusion in bioprocessing**,** oxygen transfer methodology in bioreactors and factors affecting oxygen transfer, types of microbial culture: Batch, fed batch and continuous culture.

Unit-II

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

Unit-III

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: 2024-25
Course Code: BBTM-5064 (P)
Course title: 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: 2024-25
Course Code: BBTM-5064(P)
Course title: 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: 2024-25
Course Code: BBTM-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: 2024-25
Course Code: BBTM-5065
Course title: 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. Each question carries 6 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. (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: 2024-25
Course Code: BBTM-5065
Course title: Biochemical and Biophysical Techniques-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the concept of centrifugation.

CO2: 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: 2024-25
Course Code: BBTM-5065(P)
Course title: 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: 2024-25
Course Code: BBTM-5066
Course title: 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: 2024-25
Course Code: BBTM-5066
Course title: 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. Each question carries 6 marks.

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: 2024-25
Course Code: BBTM-5066(P)
Course title: 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: 2024-25
Course Code: BBTM-5066(P)
Course title: Industrial Biotechnology-II
(Practical)

Time: 3 Hrs. **Practical Marks: 18**

Instructions for the practical Examiner:

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

Experiments:

1. Alcoholic and mixed–acid fermentation.
2. Additive and synergistic effect of two antibiotics on the above microorganism.
3. Minimum inhibitory concentration of an antibiotics for the above microorganism.
4. Demonstration of wine production by using grape juice.
5. Determination of nitrate reduction by bacteria.

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2024-25
Course Code: SECJ-5551
Course title: Job readiness Course

Course Code: SECJ-5551 Course Credits: 02 Contact Hours: 30

Objectives of the Course:

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

Learning Outcomes:

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

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

CURRICULUM

Course Code: SECJ-5551 Course Credits: 02 Contact Hours: 30

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

EXAMINATION

- **Total Marks:** 25 (Exam: 20 and Internal Assessment: 5)

- **Final Exam:** Multiple Choice Quiz and/or practice/mock tests - Marks – 20; Time: 1 to 2 hours depending upon the batch size of 10-20 participants

- **Internal Assessment:** 5 (Assessment: 3; Attendance:2)

    - Comparative assessment questions (medium length) in the beginning and at closure of the programme. Marks: 3; Time: 0.5 hour each at the beginning and end.

- **Total marks:** 25 converted to grade for final result

- **Grading system:**

90.1% -100% marks: O grade

80.1% - 90% marks: A+ grade

70.1% - 80% marks: A grade

60.1% - 70% marks: B+ grade

50.1% -60% marks: B grade

45%- 50 % marks: C grade

35%-44.9% marks: P grade

Below 35% marks: F grade

Absent: Ab

B. Sc. Bio-Technology Semester-VI

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2024-25
Course Code: BBTM-6061
Course title: 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: 2024-25
Course Code: BBTM-6061
Course title: 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: 2024-25
Course Code: BBTM-6061(P)
Course title: 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: 2024-25
Course Code: BBTM-6061(P)
Course title: 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: 2024-25
Course Code: BBTM-6062
Course title: 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: 2024-25
Course Code: BBTM-6062
Course title: 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: 2024-25
Course Code: BBTM-6062(P)
Course title: 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: 2024-25
Course Code: BBTM-6062(P)
Course title: 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: 2024-25
Course Code: BBTM-6063
Course title: 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: 2024-25
Course Code: BBTM-6063
Course title: 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: 2024-25
Course Code: BBTM-6063(P)
Course title: 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: 2024-25
Course Code: BBTM-6063(P)
Course title: 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: 2024-25
Course Code: BBTM-6064
Course title: Bioprocess Engineering-II with training (Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

CO3: Study about different techniques of downstream processing.

CO4: Learn about effluent treatment and fermentation economics.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2024-25
Course Code: BBTM-6064
Course title: Bioprocess Engineering-II with training
(Theory)

Time: 3 Hours **Max. Marks: 60**
Theory: 30
Practical: 18
CA: 12

Instructions for the Paper Setter

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

Unit-1

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

Unit-II

Control and measurement equipments of fermenter (Temperature and pH control system, flow measurement, foam sensing, pressure control and D.O. probes, operation and agitation and its kinetics.

Unit-III

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

Unit-IV

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

Books Recommended:

1.Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 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: 2024-25
Course Code: BBTM-6064(P)
Course title: Bioprocess Engineering-II with training (Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2024-25
Course Code: BBTM-6064(P)
Course title: Bioprocess Engineering-II with training
(Practical)

Time: 3 Hrs. **Practical Marks: 18**

Note:

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

Bachelor of Science (Biotechnology) Semester-VI
SESSION: 2024-25
Course code: BBTM-6085
Course title: Chemistry-III
(Theory)

Course outcome:

Students will be able to

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

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

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

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

Bachelor of Science (Biotechnology) Semester-VI
SESSION: 2024-25
Course code: BBTM-6085
Course title: Chemistry-III
(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 06 marks.

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

Bachelor of Science (Biotechnology) Semester-VI
SESSION: 2024-25
Course code: BBTM-6085(P)
Course title: Chemistry-III
(Practical)

Course outcome:

Students will be able to

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

CO2: determine the heat of of neutralization and Heat of solution Calorimetrically

CO3: verify Beer Lambert Law for different solutions.

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

Bachelor of Science (Biotechnology) Semester-VI
SESSION: 2024-25
Course code: BBTM-6085(P)
Course title: Chemistry-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.

Books Recommended:

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, NH4Cl, KNO3
2. Conductometry:
a) Determination of cell constant.
b) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl).
c) Precipitation titration of Na2SO4 vs. BaCl2.
d) Neutralization titrations NaOH vs. HCl and NaOH vs. CH3COOH.
3. Photometry.
Verification of Lambert beer's law for solution of CoCl2H2O (in water) and K2Cr2O7 (in water)
4. a) pH of buffer solution
b) Acid base titration HCl vs. NaOH.
c) Determination of ionization constant of a weak acid (CH3COOH)
5. Determine composition of HCl and CH3COOH in the given solution pH metrically.
6. Polarimetry: Determine the %age composition of an optically active solution.

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2024-25
Course Code: BBTM-6066
Course title: 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: 2024-25
Course Code: BBTM-6066
Course title: 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: 2024-25
Course Code: BBTM-6066(P)
Course title: 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: 2024-25
Course Code: BBTM-6066(P)
Course title: 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.
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Bachelor of Science (Bio-Technology) Semester-VI
Session: 2024-25
Course Code: BBTS-6067
Course title: 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.