

B.Sc. Biotechnology

Program Outcomes (PO)

PO1. Basic understanding: Knowledge regarding basic concepts of cell biology, Biochemistry, enzyme technology and Environment biotechnology.

PO2. Interdisciplinary approach: Analyse the relationships among animals, plants, microbes and Industry.

PO3. Practical learning: Perform procedures as per laboratory standards in the areas of Biochemistry, Bioinformatics, Genomics, industrial biotechnology and fermentation technology

PO4. Analytical Thinking: Perceive things and the events that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) in the light of scientific principal.

PO5. Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO6. Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO7. Effective Writing: Got Skill for Write up in scientific literature and other social media platform related to life science

PO8. Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO9. Environment and Sustainability: Understand the issues of environmental deterioration, pollution and sustainable development. Developing critical problem solving approach for these societal concerns via bioremediation and integrated management

Programme specific outcome: B.Sc. Biotechnology

PSO-1 Understanding the basic concepts of biotechnology with reference to Zoology, Botany, Microbiology and recombinant technology to appreciate how diverse phenomena observed in nature and in daily life

PSO-2 Learn to carry out experiments in basic as well as certain advanced areas of biotechnology such as Plant tissue culture biotechnology, Animal biotechnology, Enzyme Technology and Bioinformatics.

PSO-3 Understand the basic concepts of certain sub fields such as Biochemistry and Industrial biotechnology, molecular biotechnology, Environment biotechnology, Agri-biotechnology, general theory of Bioremediation and Fermentation.

PSO-4 Gain hands on experience to work in applied fields of Life Science. Learn different techniques pertaining to diverse field of biotechnology at theoretical and practical level

PSO-5 Gain a thorough Knowledge in the subject to be able to teach it at school level

PSO-6 Gaining knowledge to transform theoretical concept to practical products/process and learning laws concerning to patents and IPR

PSO-7 Viewing biotechnology as a tool the developing mind and critical attitude and the faculty of logical reasoning that is prepared to serve in diverse fields.

Course Outcomes

Course Name: **ZOOLOGY - A**

Class: **B Sc. (BIOTECHNOLOGY)**

Semester - **I**

Objectives of the course:

1. To study the digestive system and nutrition in humans
2. To study the circulatory system and role of blood in circulation
3. To study the process of respiration and its associated organs.
4. To study the integuments and its derivatives in human.

Course Outcomes:

1. Students are able to understand the physiology at cellular and system levels .
2. Students are able to describe the role and functions of different systems.
3. Students are able to describe the physiology of digestive, respiratory, circulatory and integumentary systems to define normal and abnormal functions.
4. Students are able to understand how physiological parameters are measured in mammals.

Course Name: BT–2 Botany–A

Class: B Sc. (BIOTECHNOLOGY)

Semester - I

Objectives of the course:

1. To understand the scope & importance of Anatomy and Embryology.
2. To understand the vascular tissues, structure of woods and anomalous secondary growth, anatomical variations and tissue systems in plant shoot system.
3. To know various tissue systems and understand the normal and anomalous secondary growth in plants.
4. To understand structure and development in microsporangium and megasporangium, microsporogenesis and megasporogenesis.
5. To understand male and female gametophytes, fertilization, endosperm and embryogeny.

Course Outcomes:

- (a) Knowledge and Understanding:** Students will come to know about historical development of embryology, understand structure and development of microsporangium, megasporangium, embryo and endosperm, know the methods of pollination and fertilization.
- (b) Intellectual Cognitive /Analytical skills:** Students will be able to understand the applications of embryology in plant tissue culture and realize the applications of palynology in human welfare.
- (c) Practical skills:** Microscopic examination of the embryological preparations to understand anther structure, embryo sacs, different types of ovules, placentation types etc.
- (d) Transferable skills:** Students will be able to work as an individual as well as in a team to work on different aspects of plant anatomy and embryology and will be able to communicate about these aspects.

Course Name: BT3 (INORGANIC CHEMISTRY–A)

Class: B.Sc (Biotechnology)

Semester :I

Objective of the course:

This course aims at imparting knowledge in fundamental aspects of Inorganic chemistry. To acquire basic knowledge in the specialized areas of chemistry. To train the students in various quantitative and qualitative analysis.

Course outcomes

Students will

- Know how to define the various concepts of inorganic chemistry.
- Understand and explain the basic concepts associated with the different valence, molecular orbital theory.
- Identify the various types of theories.
- Analyze the various concepts valence bond theory, crystal field theory.
- Learn Needs for the concepts of molecular orbital theory.
- Applications of various theories of structures of compounds
- Describe the various properties of inorganic chemistry.
- Concepts of coordination chemistry.
- Assign the various structures and geometries on basis of valence bond theory.
- Applications of crystal field theory and molecular orbital theory.

COURSE OUTCOMES

Course Name: BT4 (**ORGANIC CHEMISTRY–A**)

Class: **B.Sc (Biotechnology)**

Semester :**I**

Objective of the course:

To make aware about the various concepts of organic chemistry and reaction mechanisms.

Course outcomes

Understanding and explanation of the basic concepts associated with the different

valence, molecular orbital theory and nucleophilic and electrophilic substitution reactions.

Identifying the various types of configurations and confirmations in organic compounds.

COURSE OUTCOMES

ਕੋਰਸ ਦਾ ਨਾਂਲਾਜ਼ਮੀ ਪੰਜਾਬੀ

ਕਲਾਸਬੀ ਏ/ਬੀ ਐੱਸ ਸੀ/ਬੀ ਕੈਮ ਸਮੈਸਟਰਪਹਿਲਾ

ਕੋਰਸ ਦਾ ਉਦੇਸ਼

- * ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਮਾਤ ਭਾਸ਼ਾ ਨਾਲ ਜੋੜੀ ਰੱਖਣ ਲਈ ਇਸਦੀ ਮਹੱਤਤਾ ਬਾਰੇ ਦੱਸਣਾ
- * ਪੰਜਾਬੀ ਸਾਹਿਤ ਬਾਰੇ ਜਾਣਕਾਰੀ ਪ੍ਰਦਾਨ ਕਰਨਾ
- * ਸਾਹਿਤਕ ਰੁਚੀਆਂ ਪੈਦਾ ਕਰਨਾ
- * ਸੰਵਾਦ ਰਚਾਉਣ ਦੇ ਯੋਗ ਬਣਾਉਣਾ
- * ਸਾਹਿਤ ਅਤੇ ਸਮਾਜ ਦੇ ਆਪਸੀ ਸੰਬੰਧ ਬਾਰੇ ਦੱਸਣਾ

ਕੋਰਸ ਨਾਲ ਹੋਣ ਵਾਲੀਆਂ ਪ੍ਰਾਪਤੀਆਂ ਦੀਆਂ ਸੰਭਾਵਨਾਵਾਂ

(ੳ) ਬੌਧਿਕ ਹੁਨਰ

- * ਸ਼ੁੱਧ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਲਿਖਣ ਅਤੇ ਪੜ੍ਹਨ ਦੇ ਯੋਗ ਹੋਣਾ
- * ਸਾਹਿਤ ਬਾਰੇ ਗਹਿਰਾਈ ਨਾਲ ਜਾਣਕਾਰੀ ਹੋਣਾ

- * ਕਵਿਤਾ ਅਤੇ ਵਾਰਤਕ ਦਾ ਅੰਤਰ ਪਤਾ ਹੋਣਾ
- * ਹੋਰ ਭਾਸ਼ਾਵਾਂ ਦੀਆਂ ਸਾਹਿਤਕ ਕਿਰਤਾਂ ਦੀ ਜਾਣਕਾਰੀ ਹੋਣਾ

(ਅ) ਅਮਲੀ ਹੁਨਰ

- * ਮਾਤ ਭਾਸ਼ਾ ਪ੍ਰਤੀ ਸਤਿਕਾਰ ਦੀ ਭਾਵਨਾ
- * ਵਿਸ਼ਿਆਂ ਦੀਆਂ ਗੁੰਝਲਾਂ ਨੂੰ ਸੁਲਝਾਣ ਦੀ ਯੋਗਤਾ
- * ਸਾਹਿਤ ਰਚਣ ਦੀ ਯੋਗਤਾ
- * ਈ-ਸਰੋਤਾਂ ਬਾਰੇ ਜਾਣਕਾਰੀ ਹੋਣਾ

(ੲ) ਵਿਸ਼ੇ ਨੂੰ ਵਿਹਾਰਕ

ਪੱਧਰ 'ਤੇ ਵਰਤਣ

ਦਾ ਹੁਨਰ

- * ਸੰਚਾਰ ਕਰਨ ਦੀ ਯੋਗਤਾ
- * ਟੀਮ ਵਰਕ ਦੀ ਯੋਗਤਾ
- * ਚੰਗੀ ਲੀਡਰਸ਼ਿਪ ਦੀ ਯੋਗਤਾ
- * ਸਮਸਿਆਵਾਂ ਨੂੰ ਸਮਝਣ
ਅਤੇ ਹੱਲ ਕਰਨ ਦੀ ਯੋਗਤਾ
- * ਚੰਗੇ ਭਾਸ਼ਾ ਅਧਿਆਪਕ ਬਣਨ ਦੀ ਸਮਰਥਾ

Paper Name: Course No. Computers & Bioinformatics Fundamentals (BT – 5)

Class: B.Sc. Biotechnology Semester: Ist

Objective of the Course:

This course aims at acquainting students with various concepts and basic techniques essential for conduct of practical and research, to get in-depth understanding of scientific knowledge. It also aims at to acquainting students with principal and instrumentation *visa-a vis* application and

suitability of technique to conduct practical and research. It also aims to familiarise the student with principle, theory and mathematical calculation governing the technique.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about computer and Bioinformatics
- Understanding the basic concept associated with sequence analysis
- Students will develop basic understanding about various biological databases.

B. Intellectual (Cognitive/Analytical) skills:

- Interpretation of the results of Pairwise and Multiple sequence analysis.
- Sequence analyses on the basis of various default parameters.
- Able to use and implement various options on Ms-Office (word, Excel, Power-point)
- Understanding various databases and tools

C. Practical skills:

- Ms-Office: word, Excel, Power-point
- Introduction about Various Databases at NCBI, EMBL, DDBJ.
- GenBank Format, FASTA format etc
- Basic Local Alignment Search tools (BLAST)

D. Transferable skills:

- Suitability of various tools for sequence analysis
- Homology prediction using Basic Local Alignment Search tools (BLAST)
- Characterization of various database flat file format.

Course Name: Problem Of Drug Abuse: Management And Prevention

Programme : B.Sc. Biotechnology Ist Sem

Objectives of the Course:

The objective of course is to explore Meaning, Nature and Extent of Drug Abuse in India and Punjab. It provides knowledge Consequences of Drug Abuse for individual, family, society and nation. It also explains the Medical Management, Psychiatric Management, and Social Management. It explore the prevention and management of the drug abuse.

Course Outcomes:

A. Knowledge and Understanding):

Students will

- Understand the Meaning of Nature and Extent of Drug Abuse in India and Punjab and Consequences of Drug Abuse
- Understand the management of the Drug Abuse
- Understand the Prevention of Drug Abuse
- Understand the Controlling Drug Abuse

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to

- Identify the difference between varieties of drugs.
- Know the types of drug abuse.
- Think critically regarding the prevention and management of drug abuse.
- Provide awareness, seminar, camps regarding drug abuse
- The NDPs act, Statutory warnings, Policing of Borders
-

D. Transferable Skills:

Students will be able to

- Communicate with public during seminars.
- Work with the de-addiction centers.
- Provide counseling, family and group therapy.
- Do advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program.

Course Name: General Microbiology- A (BT-8)

Class: B.Sc. Biotechnology Semester: I

Objective of the Course:

The course is designed for the students entering First year of Bachelor degree in Biotechnology. The primary aim of this course is to instigate the students with a new branch of biotechnology i.e. General Microbiology. The course is designed with the preliminary principles of Microbiology and advanced accomplishments in the last two or three decades, followed by introduction to the mechanism such as Microscopic techniques and elaboration on the different instruments employed to visualize and analyze these microorganisms. It also aims to familiarize the student with current topics of microbiology such as microbes in extreme environments, culture collection, purification and preservation, nature of the microbial cell surface and bacterial classification.

Course Outcomes:

The course provide and introduction to the scientific principles and theory of various techniques indispensable for experimentations concentrating on Microbiology. It explores the various techniques that had played tremendous role in visualization, cultivation of different types of microorganisms under lab conditions. The course conceptualizes the various phenomena helpful in scientific innovation and discoveries. The course is backbone for the students interested in Microbiology and those who want to develop carrier in Microbiology at industrial level. Further the students will be deliberated upon the staining techniques, and various methods to classify microbes etc.

E. Knowledge and understanding:

- Basic understanding about concept of Principles of Microbiology and its types.
- Understanding the necessary concept coupled with classification of bacteria.
- Students will be developing basic understanding about general features of bacteria, fungi and viruses.
- Students will learn the basic concept of mechanism of bacterial nutrition, culture collection and its preservation.

Course Name: BIOCHEMISTRY- A BT-9

Class: B.Sc. (Biotechnology) Semester: I

Objective of the Course:

This course aims at conversing students with various concepts and basic techniques essential for conduct of theoretical and practical work in the field of biochemistry and has an understanding of scientific knowledge. It is concerned with the chemical nature and chemical behavior of the living matter. It involves structure, organization and functions of biomolecules in organisms.

Course content:

Water and its Properties: Its Structure, Physico-chemical Properties, pH, buffers, pI, pka, Hasselbach Henderson equation. Carbohydrates, Families of monosaccharides, Mutarotation, Structure and functions of Sugar. Structural and functional properties of Polysaccharides: storage polysaccharides and Structural Polysaccharides .Structure and role of proteoglycans, glycoproteins and glycolipids. Nucleic acid structure and chemistry. Structure and functions of biologically important nucleotides.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about significance of water
- Students will go through various classes of carbohydrates.
- Students will learn about glycoproteins and glycolipids.
- Students will understand the basics of nucleic acid structure and chemistry.

B. Intellectual (Cognitive/Analytical) skills:

- Understanding the importance of biomolecules in structure and physiology.
- Nutritional aspects of biomolecules

C. Practical skills:

- Preparation of physiological buffers.
- Verification of Beer Lamberts Law for P-nitrophenol or cobalt chloride.
- Determination of pKa value of P-nitrophenol
- Estimation of carbohydrate in given solution by anthrone method & dubois method
- Estimation of DNA/RNA

D. Transferrable skills:

- Communication skills
- Thinking skills
- Education

Course Name: **ZOOLOGY - B**

Class: **B Sc. (BIOTECHNOLOGY)**

Semester - **II**

Objectives of the course:

1. To study the Urinogenital system and urine formation in humans
2. To study the endocrine system and its role.
3. To study the nervous system and its associated organs.
4. To study the skeletal system and muscle contraction in human.

Course Outcomes:

1. Students are able to understand the physiology at cellular and system levels.
2. Students are able to describe the role and functions of different systems.
3. Students are able to describe the physiology of Urinogenital, endocrine, nervous, skeletal systems and muscle contraction to define normal and abnormal functions.
4. Students are able to understand how physiological parameters are measured in mammals.

Paper Name: Botany-B

Class: B.Sc (BIO-TECHNOLOGY) Sem: IInd

Objectives of the course:

This course aims to identify all the kinds of plants on earth with their names, distribution, habit, characteristics and affinities. It also aims to arrange the kinds of plants into a scheme of classification or an orderly arrangement.

Course Outcomes:

Knowledge and understanding:

Students will

- Know the significant difference between old and modern systems of classification.
- Learn about various kinds of plants on the earth.
- Understand the evolutionary status of families of angiosperms.
- Describe the characters of some plants.
- Know the difference between seed and grain.
- Student will understand the seed biology.

Intellectual skills:

Students will

- Compare between past and modern classification systems.
- Compare the characteristics of families of angiosperms

Practical skills:

Students will

- Use the simple microscope to identify different botanical samples.
- Demonstrate the main features of many flowers.
- Will be aware about different plant species in their surroundings.

Transferable skills:

Students will

- Aware people about the economic importance of plants.
- Will be able to demonstrate different plants across their environment.

Course Name: Inorganic Chemistry-B BT - 3

Programme : B.Sc BIOTECHNOLOGY Semester: II

Objectives of the Course:

This course aims at imparting knowledge in fundamental aspects of all branches of chemistry. It aims at making students acquire basic knowledge in the specialized areas of chemistry and trains them in various quantitative and qualitative analyses.

Course Outcomes:

B. Knowledge and Understanding):

Students will

- Know how to define the various concepts of inorganic chemistry.
- Understand and explain the basic concepts associated with the different aspects of pie acid ligands,alkali metals,co-ordination complexes.
- Students will understand and be able to describe the metal ions in biological systems.

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to

- Identify the properties of co-ordination complexes.
- Analyze chemical bonding pie acid ligands, showing their structure , bonding.
- Needs for alkali metals and alkaline earth metal chelorates .
- Applications of metal ions in biological systems.
-

C. Practical Skills

Students will learn to:

- Describe the various properties of co-ordinated complexes,
- Derive equations for bond order and structure of pie acid ligands.
- Assign the appropriate factors for stability of complexes.
- Applications of metal ions in biological systems.

D. Transferable Skills :

Students will be able to

- draw structures of pie acid ligands.
- Learn to think more creatively as well as comparatively, and
- Display better applications for metal ions in biological systems.

Course Name: BT4 (**ORGANIC CHEMISTRY–B**)

Class: **B.Sc (Biotechnology)**

Semester :**II**

Objective of the course:

- This course aims at acquainting students with the knowledge of various terms related to organic chemistry.
- To understand the fundamentals of spectroscopy and various nucleophilic reactions related to carbonyl compounds.

Course outcomes

Acquiring the basic knowledge of mechanisms together with reagents and general conditions for the reactions involved in the syllabus

Understanding and explanation of the basic concepts associated with the different valence, molecular orbital theory and nucleophilic and electrophilic substitution reactions.

Identifying the various types of configurations and conformations in organic compounds.

Course: Biostatistics

Class: B.Sc(Bio-Technology) Semester: II

Course Objectives:

Biostatistics provides rigorous training in statistical theory and methodologies that are suitable for applications in research, collaboration and consulting on a broad spectrum of health and life science problems. The main purpose of the course is to enable the students to describe and explain the data in with best descriptive

statistics measurements and how calculate probability of different events in addition to some important measurements related to clinical studies and industry.

Course Outcomes:

A. Knowledge and Understanding:

Student will be able to

- Learn statistical methods to analyze summarize and present data.
- Demonstrate an understanding of the central concepts of modern statistical theory and their probabilistic foundation.
- Communicate the results of statistical analysis accurately.
- Read and learn new statistical procedures independently.
- Understand basics of probability, probability rules and conditional probability rules.
- Recognize the basic concepts of simple linear regression and correlation.
- Understand basic statistical theory to design the experiments.
- Aware the assumptions of various statistical methods before experimental design and data analysis.
- Understand the fundamental and principles of Biostatistics.

B. Intellectual(cognitive/Analytical) skills:

- Apply basic concepts of probability, probability laws in solving biological problems in the field of life sciences.
- Apply concepts and methods from biostatistics and epidemiology disciplines jointly.
- Apply and examine the goodness-of-fit test, test for independence and homogeneity.
- Differentiate between methods of data presentation.
- Differentiate between alternative and null hypothesis.
- calculate measures of central tendency and measures of dispersion.

C. Practical skills:

- Communicate effectively with biostatistician and non- biostatisticians collaborators
- Organize results in appropriate visual displays or tables.
- Have fun by crunching number and master a highly useful skill for the career.

- Use results of applied statistics to make informed decisions.
- Give examples of different types of data arising in clinical studies.

Course name: Communication Skills in English-II BT-7

Class: B.Sc. Biotechnology Semester: II

OBJECTIVES OF THE COURSE: The course is designed to help the students hone their communication skills in order to exchange the information and ideas, whether written or oral. The aim of the course is to educate the students about successful businesses and for building relationships by influencing interactions either positively or negatively. It further acquaints the students about the patterns acquired in English pronunciation, with the purpose of increasing the knowledge about phonetics and phonology and to improve the pronunciation and their listening ability.

Course Outcomes:

At the end of the course the student should be able to-

- Enumerate listening as well as speaking and conversational skills in a business communication.
- Define guidelines and etiquettes in either making or receiving telephone calls for an effective business communication.
- Cultivate the skill of Note-Taking and define its importance.
- Transcribe the words in IPA symbols.
- Mark word stress in the words of English as per the rules.
- Prepare and present oral presentation for the practical/oral testing.
- Impressively participate in a group discussion.
- Have a good command over the English language keeping in mind the tone and gestures.

Paper Name: General Microbiology- B BT-8

Class: B.Sc. Biotechnology Semester: II

Objective of the Course:

The course is designed for the students entering First year of Bachelor degree in Biotechnology. The primary aim of this course is to instigate the students with a new branch of biotechnology i.e. General Microbiology. The course is designed with the preliminary principles of Microbiology and advanced accomplishments in the last two or three decades, followed by introduction to the mechanism such as Microbial Growth, Sporulation and regeneration of bacteria and elaborates on the different instruments employed to visualize and analyze these microorganisms. It also aims to familiarize the student with current topics of microbiology such as defence mechanisms against microbial agents, pathogenic micro organisms and their role, Viral agents and fungal diseases.

Course Outcomes:

F. Knowledge and understanding:

- Basic understanding about concept of microbial growth and growth curve.
- Understanding the necessary concept coupled with classification of viruses and their life cycle.
- Students will be develop basic understanding about defence mechanisms against microorganisms.
- Students will learn the basic concept of mechanism of action, diagnosis and treatment for bacterial and fungal diseases.

G. Intellectual (Cognitive/Analtical) skills:

- Analyse the bacterial cells on the basis of their, size and shape.
- Master the staining techniques and various factors involved in visualization of microbial cells after staining.

- Understanding the bacterial growth curves.

H. Practical skills:

- To study the Enumeration of microorganism.
- Isolation of micro organisms from hands, tooth-scum and other body parts to check Personal hygiene.
- To study the Growth curve of micro-organisms.
- Identification of fungus by lactophenol staining.
- Identification of formation of germ tube by *Candida albicans*.

I. Transferable skills:

- Suitability of various techniques for separation of microbes by using different culture medium.
- Estimation of growth curve of microbes as required for scientific studies.
- Conduct and planning independent experimentation for analysis and separation of micro organisms.

Paper Name: BIOCHEMISTRY-B BT-9

Class: B.Sc. (Biotechnology) Semester: II

Objective of the Course:

This course aims at conversing students with various concepts and basic techniques essential for conduct of theoretical and practical work in the field of biochemistry and has an understanding of scientific knowledge. It is concerned with the chemical nature and chemical behavior of the living matter. It involves structure, organization and functions of biomolecules in organisms.

Course Outcomes:

E. Knowledge and understanding:

- Basic understanding about various biomolecules involved.
- Students will go through various classes of lipids.
- Students will learn about essential and non essential amino acids.
- Students will of vitamins and hormones

F. Intellectual (Cognitive/Analytical) skills:

- Understanding the importance of biomolecules in structure and physiology.
- Nutritional aspects of biomolecules

G. Practical skills:

- Estimation of protein by spectrophotometric analysis.
- Measurement of acid value and saponification value of fats by titration.

H. Transferrable skills:

- Communication skills
- Thinking skills
- Education

Course Name: BT1 (**Physical CHEMISTRY–A**)

Class: **B.Sc (Biotechnology)**

Semester :**III**

Objective of the course:

This course aims at imparting knowledge in fundamental aspects of Physical chemistry. To acquire basic knowledge in the specialized areas of chemistry. To train the students in understanding physical aspects of chemical reactions.

Course outcomes

Students will be able to

Know how to define the various concepts of physical chemistry.

- Understand and explain the basic concepts associated with the thermodynamic.
- Identify the various types of solutions.
- Analyze the various concepts and laws of thermodynamics.
- Needs for the concepts of solutions.
- Applications of various laws associated with phase equilibria.
- Describe the various properties of physical chemistry.
- Concepts of thermodynamics and laws related.
- Assign the various solutions their types.
- Applications of thermodynamics, solutions and phase equilibria.
- Derive various derivations related to thermodynamic.
- Learn to think more creatively as well as comparatively
- Display better applications for thermodynamics, solutions and phase equilibria.

Paper Name: Zoology C

Class: B.Sc (Biotechnology) Sem: IIIrd

Objectives of the course:

This course aims at understanding the different pathogens causing diseases. Through this course they will come to know different kinds of diseases and preventive measures against those diseases. Moreover, it also provides information about the occurrence, spread and eradication of different diseases.

Course Outcomes:

Knowledge and understanding:

Students will

- Come to know about the different pathogens causing diseases.

- Learn about various eradication programmes to control diseases.
- Understand the immune system of the body which works against these pathogens.

Intellectual skills:

Students will

- Analyse the various features of these disease causative agents.
- Analyse different adaptations by these parasites.
- Assess different pathogens in the surroundings.

Practical skills:

Students will

- Work to protect themselves from different diseases.
- Aware about different pathogenic organisms and their prevention.

Transferable skills:

Students will

- Aware people about occurrence and spread of diseases and their causative agents
- Also aware them about the preventive measures taken to get rid off these pathogens.

Paper Name: BIOCHEMISTRY III BT-3

Class: B.Sc. (Biotechnology) Semester: III

Objective of the Course:

This course takes into account the studies related to the chemical constituents of living matter, their transformations in biological systems and the energy changes associated with these transformations. Detailed study of all the metabolic reactions will be discussed in this module.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about Basic principles of metabolism and bioenergetics.

- Students will gain knowledge in various constituents of diet, their consumption and Energy production.

B. Intellectual (Cognitive/Analytical) skills:

- Better understanding of metabolic reactions within the body.
- Complete learning of biosynthesis and degradations of different biomolecules.

C. Practical skills:

- Quantitative estimation of amino acids
- Methods for separation of macromolecules

D. Transferrable skills:

- Communication skills
- Thinking skills
- Education

Paper Name: CELL BIOLOGY

BT-4

Class: B.Sc. (Biotechnology) Semester: III

Objective of the Course:

This course aims at familiarizing students with various cell organelles structure and functions. It also aims to explore the students with habitat of various cellular bodies, cellular interactions and cell adhesion. It help in understanding of signal transduction and membrane models.

Course Outcomes:

A. Knowledge and understanding:

- Detailed understanding about cellular organelles and their functions
- Students will learn the biological processes within cell.
- Students will learn about various stages of cell cycle and cell division.
- Students will gain knowledge in areas of cellular locomotion and interaction.

B. Intellectual (Cognitive/Analytical) skills:

- Basic techniques essential for studying cell
- Cellular function and core study

C. Practical skills:

- Microscopy: Principles, use and care of compound, phase contrast, electron microscopy.
- Study of Cells Prokaryotic cells and Eukaryotic cells.
- Study of electron micrographs of various cell organelles.
- Microtomy and preparation of permanent slides.

Transferrable skills:

- Communication skills
- Thinking skills
- Education

Course Name: **GENETICS**

Class: **B Sc. (Biotechnology)**

Semester - **III**

Objectives of the course:

1. To understand how the behavior of chromosomes during meiosis can explain mendal law.

2. To understand how inheritance patterns are affected by position on chromosomes
3. To understand the similarities and differences between how genetic information is passed on in prokaryotes and eukaryotes.
4. To understand gene interactions.
5. To understand the chemical nature of heredity.

Course Outcomes:

1. Comprehensive and detailed understanding of the chemical basis of heredity.
2. Understanding about the role of genetics in evolution.
3. The ability to evaluate conclusions that are based on genetic data.
4. The ability to understand results of genetic experimentation in animals.

Paper Name: Basic concepts in Immunology

BT-5

Class: B.Sc. (Biotech) Semester: III

Objective of the Course:

This course aims at familiarizing students with concepts of immune system and its components that provide disease resistance against various infections for an entire human life. Recognizing the necessary and unbeatable role played by the small soldiers of immune system causes the students to be inquisitive and generates an exploring approach towards the subject.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about concepts of immunology.
- Students will learn the basic techniques essential in immunological experimentation
- Basics of students will be build up in understanding the mechanism of the body behind fighting a particular disease.

B. Intellectual (Cognitive/Analytical) skills:

- Use of immunological techniques in science
- In research and development areas

C. **Practical skills:**

- Studying antigen antibody interaction
- Hands on performing practically used techniques
- Comprehending and evaluating the results

D. **Transferrable skills:**

- Communication skills
- Thinking skills
- Theoretical Skills

Paper Name: Agro and Industrial applications of microbes - A (BT-7)

Class: B.Sc. (Biotech) Semester: III

Objective of the Course:

This course aims at bringing into light the basic concepts of microbial interactions and the industrial processes involved. It will help students understand the interaction of microbes in industrially important products. The use and effectiveness of the microorganisms in our day to day lives will help students build a better understanding in the field of microbial based industries and the opportunities lying within.

Course Outcomes:

I. **Knowledge and understanding:**

- Basic understanding about concepts of maintenance and improvement programs of microbes in generak.
- Students will learn the basic techniques essential in isolation and identification of microbes.
- Understanding the dynamics between microbes, their interactions and human society

J. Intellectual (Cognitive/Analytical) skills:

- Use of simple techniques for the isolation of microbes
- Analyzing and interpreting the basic microbial contamination patterns

K. Practical skills:

- Isolation and identifying the microbes
- Hands on performing practically used techniques
- Comprehending and evaluating the results

L. Transferrable skills:

- Communication skills
- Thinking skills
- Theoretical Skills

Course Name: Environmental Studies (ELS 221)

Semester: B.Sc. Biotechnology

Semester- III

Objectives of the Course:

This course aims to develop concern and to acquaint students with information related to environment. Its main objective is to develop concern in each individual to save the environment. Its main aim is to create awareness about sustainable development. It also works to spread

awareness among the students on issues like Global warming, Climate change, Depletion of Natural resources, Declining water table and Pollution etc. Its ultimate aim is to create GREEN INDIA CLEAN INDIA.

Course Outcomes:

C. Knowledge and Understanding):

Students will

- Know multidisciplinary nature of Environmental studies its scope and importance.
- Understand and explain the various natural resources, Ecosystems, Environmental Pollutions and their control measures.
- Understand various Social issues, like Global warming, Acid rain, Climate change and disaster management.

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to

- identify the various Environmental problems and their possible solutions.
- analyze various social issues and their possible solutions
- analyze different types of Pollution and their control measures.

C. Practical Skills

Students will learn to:

- Plant tree species, Flowering species, vegetative propagation etc.
- Solid waste management (segregation of solid waste, disposal methods etc).
- Do Composting, Vermicomposting.
- Do disaster management.

D. Transferable Skills :

Students will be able to

- Manage solid waste, electronic waste, agriculture waste effectively in the society.
- learn to think more creatively to increase forest cover by Rotational cutting pattern.
- display better hygienic conditions in Society.

Course Name: **BT-2 Botany–C**

Class: **B Sc. (Biotechnology)**

Semester - **IV**

Objectives of the course:

1. To introduce concepts and principles of plant pathology.
2. To provide the knowledge regarding importance of sign and symptoms for detection of pathogens and disease, integrated methods of disease management, use of biological and chemicals in disease management.
3. To understand the plants and plant cells in relation to water. Learn about the movement of sap and absorption of water in plant body.

Course Outcomes:

- (a) **Knowledge and Understanding:** Student will know about concept of disease, causal agents of plant diseases, identification methods and management of crop diseases.
- (b) **Intellectual Cognitive /Analytical skills:** Students will be able to identify different plant diseases of the local area and analyse the requisites for minimizing the disease occurrence in the area.
- (c) **Practical skills:** Students will know various laboratory methods of detection of plant pathogens and evaluation of biological and chemical agents against plant pathogens.
- (d) **Transferable skills:** communicate the knowledge or interact at different levels to spread awareness regarding common plant diseases and contribute in providing solutions for the disease occurrence or damage caused by the disease to the economically important plants.

Course Name: Physical Chemistry -B

Class: B.Sc. Biotechnology Semester: IV

Objectives of the Course:

This course aims at imparting knowledge in fundamental aspects of all branches of chemistry. To acquire basic knowledge in the specialized areas of chemistry. To train the students in various quantitative and qualitative analysis.

Course Outcomes:**A. Knowledge and Understanding:**

Students will

- Know how to define the various concepts of gaseous state.

- Understand and explain the basic concepts associated with the different aspects of physical chemistry (e.g critical phenomena of gases).
- Students will understand and be able to describe the plots and properties of gaseous and liquid state.

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to

- Identify the phonetic properties of gaseous and liquid state.
- Analyze, the plots like PV isotherms their derivation.
- Needs for molecular velocities.
- Applications of liquid crystals.
-

C. Practical Skills

Students will learn to:

- Describe the various properties of liquid and gaseous states.
- Derive equations for velocities of gases.
- Assign the appropriate plots for real and ideal gases.
- Applications of liquid crystals.

D. Transferable Skills :

Students will be able to

- Form plots for gases.
- Learn to think more creatively as well as comparatively, and
- Display better applications for gaseous and liquid states.

Paper Name: BIOCHEMISTRY IV BT-3

Class: B.Sc. (Biotechnology) Semester: IV

Objective of the Course:

This course takes into account the studies related to the chemical constituents of living matter, their transformations in biological systems and the energy changes associated with these transformations. Detailed study of all the metabolic reactions will be discussed in this module.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about metabolism related to biomolecules.

- Students will gain knowledge in various constituents of diet, their consumption and deficiency diseases.

B. Intellectual (Cognitive/Analytical) skills:

- Better understanding of metabolic reactions within the body.
- Complete learning of biosynthesis and degradations of different biomolecules.

C. Practical skills:

- Quantitative estimation of amino acids
- Methods for separation of macromolecules

D. Transferrable skills:

- Communication skills
- Thinking skills
- Education

Paper Name: CELL BIOLOGY BT-4

Class: B.Sc. (Biotechnology) Semester: IV

Objective of the Course:

This course aims at familiarizing students with various cell organelles structure and functions. It also aims to explore the students with different stages of cell cycle, reproduction, cellular interactions and cell death.

Course Outcomes:

A. Knowledge and understanding:

- Detailed understanding about cellular organelles.
- Students will learn the biological processes within cell.
- Students will learn about various cell cycle stages and its regulation
- Students will gain knowledge in areas of cellular locomotion and interaction.

B. Intellectual (Cognitive/Analytical) skills:

- basic techniques essential for studying cell
- Cellular function and core study

C. Practical skills:

- Microtomy and permanent slide preparation
- Detailed study of organelles through microscopy

D. Transferrable skills:

- Communication skills
- Thinking skills
- Education

Paper Name: Immunotechnology (BT-5)

Class: B.Sc. (Biotech) Semester: IV

Objective of the Course:

This course aims at introducing various concepts and basic techniques essential for conduct of practical and research work in the field of immunology and have an understanding of scientific knowledge of the subject to the students. It also aims to explore the principle, theory and techniques involved for proper comprehension of the subject.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about concepts of immunology.
- Students will learn the basic techniques essential in immunological experimentation
- Basics of students will be build up in understanding the mechanism of the body behind fighting a particular disease.

B. Intellectual (Cognitive/Analytical) skills:

- Use of immunological techniques in science
- In research and development areas

C. Practical skills:

- Studying antigen antibody interaction
- Hands on performing practically used techniques
- Comprehending and evaluating the results

D. Transferrable skills:

- Communication skills
- Thinking skills
- Theoretical Skills

Paper Name: Molecular Biology

Class: B.Sc (Biotechnology) Sem: IVth

Objectives of the course:

This course provides knowledge about molecular biology and explains its functional role in our life. The student will be able to understand the DNA replication, chromosomes, DNA structure, recombination, molecular mechanisms and gene expression of different genes of prokaryotes and eukaryotes.

Course Outcomes:

(Knowledge and understanding, intellectual skills, practical skills, transferable skills)

Learning Outcomes:

(Knowledge and understanding, intellectual skills, practical skills, transferable skills)

Knowledge and understanding:

Students will

- Understand the concept and methods of inheritance.
- Know the mechanism of transcription and translation.
- Understand the recombination and molecular mechanisms.
- Understand structure of prokaryotic and eukaryotic genes.

Intellectual skills:

Students will

- Able to take useful lecture notes and to participate in classroom discussions.
- Able to understand the molecular basis of inheritance.

Practical skills:

- Demonstrate the gene expression of different genes.
- Able to explain the basic mechanisms of recombinations.

Transferable skills:

- Discuss their views and ideas, through different means (oral, written and visual)
- Use the information technology to gather information and right reports.

- Discuss about the heredity and inheritance.

Paper Name: Agro and Industrial applications of microbes- B BT-7

Class: B.Sc. (Biotech) Semester: IV

Objective of the Course:

This course aims at bringing into light the basic concepts of microbial interactions and the industrial processes involved. It will help students understand the interaction of microbes with environment and the interdependent society surrounding it. The subject will discuss about the vast industries of products that involve use of microbes in producing goods that are of huge human benefit.

Course Outcomes:

M. Knowledge and understanding:

- Basic understanding about concepts of microbial products.
- Students will learn the basic techniques essential in isolation and identification of microbes.
- Understanding the dynamics between microbes, their interactions and human society

N. Intellectual (Cognitive/Analytical) skills:

- Use of simple techniques for the isolation of microbes
- Analyzing and interpreting the basic microbial contamination patterns

O. Practical skills:

- Isolation and identifying the microbes
- Hands on performing practically used techniques
- Comprehending and evaluating the results

P. Transferrable skills:

- Communication skills
- Thinking skills
- Theoretical Skills

Paper Name: ENZYMOLOGY BT - 8

Class: B. Sc. (Biotechnology) Semester: IV

Objective of the Course:

This course aims at accustoming students with various concepts and basics of enzymes. It also aims to familiarize the students with, what an enzyme does in terms of a biological process, relate a catalyst to an enzyme, explain how activation energy operates when it comes to analyzing the rate of a biochemical reaction and the role of enzymes as it acts as a catalyst in lowering the activation energy of a biochemical reaction etc.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about enzymes.
- Students will learn about the structure and function of a protein so that they can relate this to how an enzyme operates.

- Students would be familiar with factors such as temperature and pH that can affect biological systems, specifically, how they affect protein.
- Students will gain knowledge in areas relating to enzymology

B. Intellectual (Cognitive/Analytical) skills:

- Use of enzymes to raise economic value
- Industrial applications

C. Practical skills:

- Use of various instruments, apparatus and techniques
- Determination of enzyme activity

D. Transferrable skills:

- Communication skills
- Thinking skills
- Education

Paper Name: rDNA Technology- A

BT-1

Class: B.Sc. (Biotech) Semester: V

Objective of the Course:

This course aims at bringing into light the basic concepts of gene recombination, enzymes that are beneficial and are of utmost importance with learning of simple processes involved in recombination. Students will learn about the basic utilities involved in this skillful subject that forms the basis of different research areas.

Course Outcomes:

Q. Knowledge and understanding:

- Basic understanding about concepts of rdna.
- Learning basic recombination techniques.
- Understanding the importance of enzymes and their functionality in different processes.

R. Intellectual (Cognitive/Analytical) skills:

- Techniques that will help learn the use of recombinant DNA.
- Analyzing and interpreting the results

S. Practical skills:

- Using of restriction enzymes that act as molecular scissors
- Hands on performance on techniques used in research
- Comprehending and evaluating the results

T. Transferrable skills:

- Communication skills
- Thinking skills
- Theoretical Skills

COURSE NAME: CONCEPTS IN PLAN TISSUE CULTURE

CLASS: B. SC BIOTECHNOLOGY SEMESTER V

Objectives of the course:

- to acquaint the students with the basic knowledge of plant tissue culture
- both theoretically as well as practical introduction to the basic of plant tissue culture
- introduction to the basic concept of modern technology in the transfer of genes to the plants.

Course outcome:**a) knowledge and understanding**

- Distinguish between growth and development and various factors including growth hormones and their chemical analogues.
- Biosynthesis of various plant growth hormones and their enzymology, their role in growth and development
- Basic of cellular totipotency and its role in plant tissue culture, various factors affecting the totipotency, cytodifferentiation.
- Elaborate upon the plant – explant – plant concept and will be able to answer what is explant, and how differentiation – dedifferentiation – redifferentiation plays a role.

b) analytical skills

- Know the composition of plants wrt to its elementary structure .i.e. the presence of various elements, their composition and role in plant metabolism
- Deliberate upon the deficiency symptoms of various elements vis-à-vis its role in development of plants their significance in plant tissue culture
- Concept of modern methods of gene transfer in plants by both direct and indirect approaches, its basics

c) practical skills

- Understand the layouts of the plant tissue culture
- Perform various steps involved in plant tissue culture
- Perform selection, pruning and sterilization of various explants
- Prepare the media for the culturing and sub-culturing
- Inoculate and incubate the explant under aseptic conditions in Laminar Air Flow
- Sterilize the incubation chamber

d) transferable skills

- The students will be trained and encouraged to be an entrepreneur by setting up the small industrial unit based on the plant tissue culture.

Paper Name: Animal Tissue Culture-A

BT-3

Class: B.Sc. (Biotech) Semester: V

Objective of the Course:

This course aims at familiarizing students with basic concepts and ideas essential for developing a comprehensive understanding of the subject. This course will help students for skilled preparation in general and primary conduct in practical and research work in the field of animal biotechnology. It also aims to bring into light the proper establishment and working of an ATC lab giving an insight into the future possibilities of this field and the further risks involved.

Course Outcomes:

U. Knowledge and understanding:

- Basic understanding about concepts of animal tissue culture.
- Students will learn the basic techniques essential in experimentation
- Basics of students will be build up in understanding the applications and availability of animal products

V. Intellectual (Cognitive/Analytical) skills:

- Use of simple techniques in animal tissue culture
- In research and development areas

W. Practical skills:

- Studying the quality and quantity of DNA and RNA
- Hands on performing practically used techniques
- Comprehending and evaluating the results

X. Transferrable skills:

- Communication skills

- Thinking skills
- Theoretical Skills

Paper Name : Patent Laws in Biotechnology

Class : B.SC(Biotech) Semester: V

Objective of the course:

Its aim is to encourage innovation and commercial development so that new and useful products are available to society at large. The system provides a balance between public and private interests by allowing inventors limited exclusionary rights in exchange for full disclosure of their inventions. This course introduces students to the interrelated fields of patent law, regulatory law and contract law that are vital to the biotech and biopharmaceutical sectors. It presents core concepts in a way that permits students to use them throughout their corporate, academic and government careers..

Course Outcomes

A Knowledge and Understanding:

Students will

- The course will cover following modules: Introduction to different types of IPR
- Biotech Invention: Nature and Scope

B. Intellectual (Cognitive/ Analytical Skills:

Students will be able to

- Patentability of Biotech inventions
- Patent application filing procedure.

C. Practical Skills

Students will learn to

- Claims and concept of Freedom to Operate in Biotech area
- Legal and ethical issues related to biotech patents
- Biotechnology and other forms of IPR
- Bio-entrepreneurship and IPR

D. Transferable Skills

Students will be able to

- Drafting and prosecuting patents for high-value products and technologies.
- Assessing and navigating the dense patent thicket surrounding many new technologies.
- Writing opinions and providing ongoing counseling for new and existing technologies.

Course Name: BT-5 BIOPROCESS ENGINEERING - A

Class: B.Sc. Biotechnology Semester: V

OBJECTIVES OF THE COURSE:

The course is designed for the students entering Final year Bachelors degree in Biotechnology. The primary aim of this course is to introduce the students with a field of biotechnology i.e. Bioprocess Engineering. The course is designed with the introduction regarding design of fermenters for microbial, plant and animal cells. Further the students will be deliberated upon the Microbial growth kinetics studies, effect of temperature, pH and inducer on product synthesis. The students will be explained about the concept of sterilization and design of batch and Continuous sterilization process.

Course Outcomes:

The course provide and introduction to the fundamental principles of chemical and biochemical engineering. The students will be explained about the different measurements and control during Batch, Continuous and Fed Batch fermentation in the fermenter. It explores the various techniques such as air

and media sterilization and concept of Del factor. The course is backbone for the students interested in industrial Microbiology and those who want to develop carrier in industries.

A. Knowledge and understanding:

- Basic understanding about concept of chemical and biochemical engineering.
- Understanding the necessary concept coupled with Molecular Diffusion and role of diffusion in bioprocessing.
- Students will be developing basic understanding about Microbial Growth Kinetics along with metabolic and biomass productivities.
- Students will learn the basic concept of mechanism of sterilization and design of batch and continuous sterilization process.

B. Intellectual (Cognitive/Analytical) skills:

- Analyze the doubling time of bacterial cells.
- Master the simple kinetics of microbial growth and yield coefficient.
- Understanding the bacterial growth curve pattern along with its metabolic and biomass productivities and sterilization concept.

C. Practical skills:

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

D. Transferable skills:

- Suitability of various techniques for separation of microbes by using different culture medium.
- Estimation of growth curve of microbes as required for scientific studies.

- Conduct and planning independent experimentation for analysis and separation of micro organisms.

Paper Name: BT-6 Biophysical and Biochemical Techniques- A

Class: B.Sc. Biotechnology Semester: V

Objective of the Course:

This course aims at acquainting students with various concepts and basic techniques essential for conduct of practical and research, to get in-depth understanding of scientific knowledge. It also aims at to acquainting students with principal and instrumentation *visa-a vis* application and suitability of technique to conduct practical and research. It also aims to familiarise the student with principle, theory and mathematical calculation governing the technique.

Program Learning Outcomes:

J. Knowledge and understanding:

- Basic understanding about Centrifugation and Chromatography.
- Understanding the basic concept associated with separation of molecule based upon their size, shape and onformation.
- Students will be develop basic understanding about Visible/UV spectrometry and be able to describe the separation using spectrophotometer.

K. Intellectual (Cognitive/Analtical) skills:

- Analyse the biomolecule on the basis of their, size, shape, conformation and mass.
- Master the Centrifugation and Chromatography techniques and various factors effecting the separation of molecules
- Understanding spectrophotometer and its basic operation

L. Practical skills:

- Separation of biomolecules using centrifugation
- Separation of biomolecules using paper and thin layer Chromatography
- Practical hands on experience of ion exchange and affinity Chromatography

M. Transferable skills:

- Suitability of various techniques for separation of biomolecule
- Estimation of biomolecules as required for scientific studies using spectrophotometer
- Characterization of various biomolecules
- Conduct and planning independent experimentation for analysis and separation of biomolecule.

Course Name: BT-7(Physical, organic and inorganic aspects of spectroscopy-A)

Class: **B.Sc (Biotechnology)**

Semester :**V**

Objective of the course:

This course aims at imparting knowledge in fundamental aspects of spectroscopy in chemistry. To acquire basic knowledge in the specialized areas of chemistry. To train the students in various characterization techniques.

Course outcomes

Ability to define the various concepts of spectroscopy.

- Understanding and explanation of the basic concepts associated with the UV and IR spectroscopy
- Identification of the various wavelength and related peaks of organic compounds.

- Analysis of various structures on the basis of frequency and wavelengths.
- Describing the various properties of organic spectroscopy
- Ability to find wavelength maximum and IR bands.
- Learn to think more creatively as well as comparatively and skillfully.

Paper Name: rDNA Technology- B BT-1

Class: B.Sc. (Biotech) Semester: VI

Objective of the Course:

This course steps ahead into exploring the techniques and touching other aspects of recombinant DNA technology. An insight into the subject reveals the ideas and possibilities of gene recombination through the use of simple techniques and their productive outcomes.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about concepts of rdna.
- Learning advanced techniques of rdna.
- Understanding the importance of transformed cells and their identification.

B. Intellectual (Cognitive/Analytical) skills:

- Techniques that will help learn the use of recombinant DNA.
- Analyzing and interpreting the results

C. Practical skills:

- Using of PCR that is a major tool in research field
- Hands on performance on techniques used in research

- Comprehending and evaluating the results

D. **Transferrable skills:**

- Communication skills
- Thinking skills
- Theoretical Skills

CLASS - B.Sc BIOTECHNOLOGY

SEMESTER – VI

APPLICATIONS IN PLANT TISSUE CULTRE (BT-2)

OBJECTIVES OF THE COURSE:

The course content is designed for the final semester graduate students pursuing their B.Sc. in Biotechnology under the three year degree course affiliated to GNDU, Amritsar. The course curricula is the extension of the coursed studies in the previous semester (Concept in Plant Tissue Culture) where the students has learned about the basic concept of what is tissue culture and how plants gets regenerated from explants. In this course the students will learn the various applications of plants tissue culture. Students will be taught about various techniques such as micropropagation, somatic and zygotic embryogenesis and organogenesis, etc. haploid, triploid production, various factors associated with growth and development of such plants and applications of these methods for plant production. Besides such methods, the students will be informed about the advanced technique such as protoplast culture, cell suspension culture and their role in production of large varieties of plants and production of secondary metabolites.

Learning outcomes:

After the completion of the topics, Students will be able to

Theoretically

- Know the concept of micropropagation, how to establish a plant tissue culture plants with different explants, culture establishment and associated parameters etc.
- Elaborate on embryogenesis, organogenesis and will be able to distinguish between somatic and zygotic embryogenesis, their stages of development and their role in establishing a plant tissue culture.
- Explain the concept of haploid, triploid production at both genetic and molecular level, selection of explants to produce the such plants using these techniques and their practical applications at the field level
- Design the experiments based on the various aspects of protoplast culture, its basic concept, methodology, analysis of the plants derived from protoplast fusion and culture with respect to its biochemical, physiological and other parameters and use of protoplast culture.
- Explain about cell suspension culture and the use of this technique in production of various secondary metabolites such as dyes, pharmaceutical's, antibiotics, and other such applications
- Discuss the use of plant tissue culture in germplasm conservation

Practically

The students will be asked to

- Perform selection, pruning and sterilization of various explants
- Prepare the media for the culturing and sub-culturing
- Sterilize the incubation chamber, inoculate and incubate the explant under aseptic conditions in Laminar Air Flow
- Use different conc. of growth such as auxins, cytokinin, gibberalinetc and observe their results for the on-hand practical training
- Perform the micropropagation using different explants such as anthers (Haploid Production), endosperm (Triploid Production) ovary and ovular culture and examine their results

Paper Name: Intellectual Property Rights and Entrepreneurship

Class: B.Sc. (Biotechnology) **Semester:** VI

Objective of the course:

Its aim is to encourage innovation and commercial development so that new and useful products are available to society at large. The system provides a balance between public and private interests by allowing inventors limited exclusionary rights in exchange for full disclosure of their inventions. This course introduces students to the interrelated fields of IPR, regulatory law and Entrepreneurship that are vital to the biotech and biopharmaceutical sectors. It presents core concepts in a way that permits students to use them throughout their corporate, academic and government careers.

Course Outcomes

A Knowledge and Understanding:

Students will

- The course will cover following modules: Introduction to different types of IPR
- Biotech Invention: Nature and Scope

B. Intellectual (Cognitive/ Analytical Skills):

Students will be able to

- Intellectual Property Rights of Biotech inventions
- IPR application filing procedure.

C. Practical Skills

Students will learn to

- Claims and concept of Freedom to Operate in Biotech area
- Legal and ethical issues related to biotech patents
- Biotechnology and other forms of IPR
- Bio-entrepreneurship and IPR

E. Transferable Skills

Students will be able to

- Drafting and prosecuting IPR for high-value products and technologies.
- Assessing and navigating the dense IPR thicket surrounding many new technologies.
- Writing opinions and providing ongoing counselling for new and existing technologies.

Paper Name: Animal biotechnology (BT-3)

Class: B.Sc. (Biotechnology) Semester: VI

Objective of the Course:

This course aims at familiarizing students with basic concepts and ideas essential for developing a comprehensive understanding of the subject. This course will help students for skilled preparation in general and primary conduct in practical and research work in the field of animal biotechnology. It also aims to bring into light the proper establishment and working of an ATC lab giving an insight into the future possibilities of this field and the further risks involved.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about concepts of animal tissue culture.
- Students will learn the basic techniques essential in experimentation
- Basics of students will be build up in understanding the applications and availability of animal products

B. Intellectual (Cognitive/Analytical) skills:

- Use of simple techniques in animal tissue culture
- In research and development areas

C. Practical skills:

- Studying the quality and quantity of DNA and RNA
- Hands on performing practically used techniques

- Comprehending and evaluating the results

D. Transferrable skills:

- Communication skills
- Thinking skills
- Theoretical Skills

Paper Name: BT-5 BIOPROCESS ENGINEERING - B

Class: B.Sc. Biotechnology Semester: VI

OBJECTIVES OF THE COURSE:

The course is designed for the students entering Final year Bachelors degree in Biotechnology. The primary aim of this course is to introduce the students with a field of biotechnology i.e. Bioprocess Engineering. The course is designed with the introduction regarding design of fermenters for microbial, plant and animal cells, followed by introduction to the components of fermenter such as impeller, sparger and baffles etc. and elaborates on the different instruments employed for the recovery of products. Further the students will be deliberated upon the control and measurement equipments of fermenter such as pH and DO probes etc. The students will be explained about the different downstream processes in detail.

Course outcomes:

After the completion of the topics, Students will be able to

- Understand the different types of fermenters design.
- Comprehend and distinguish different components of fermenter.
- Differentiate various physical and chemical methods for cell disruption at industrial scale.
- Elaborate on the use of various downstream processes for their application in the areas of product recovery.

Paper Name: BT-6 Biophysical and Biochemical Techniques- B

Class: B.Sc. Biotechnology Semester: VI

Objective of the Course:

This course aims at acquainting students with various concepts and basic techniques essential for conduct of practical and research, to get in-depth understanding of scientific knowledge. It also aims at to acquainting students with principal and instrumentation *visa-a vis* application and suitability of technique to conduct practical and research. It also aims to familiarise the student with principle, theory and mathematical calculation governing the technique.

Course Outcomes:

A. Knowledge and understanding:

- Basic understanding about electrophoresis (Agarose, PAGE)
- Understanding the basic concept associated with separation of molecule based upon their size, shape and Charge
- Students will be develop basic understanding about Mass spectrometry and be able to describe the separation using mass spectrometer.
- Students will learn the basic concept of radioisotope and be able to describe their application in various techniques

B. Intellectual (Cognitive/Analtical) skills:

- Analyse the biomolecule on the basis of their, size, shape, charge and mass.
- Master the electrophoresis techniques and various factors effecting the electrophoresis
- Understanding mass- spectrometer and it6s basic operation
- Use of radio-isotopes in the biological science

C. Practical skills:

- Qualitative and quantitative analysis of DNA sample
- Preparation of standard curve of protein
- Preparation of standard curve of DNA.
- Casting of vertical and horizontal gels for electrophoresis.
- Separation of bio-molecules by vertical and horizontal gel electrophoresis

D. Transferable skills:

- Suitability of various techniques for separation of biomolecule
- Estimation of biomolecules as required for scientific studies
- Characterization of various biomolecules
- Conduct and planning independent experimentation for analysis and separation of biomolecule.

Course Name: **BT-7(Physical, organic and inorganic aspects of spectroscopy-B)**

Class: **B.Sc (Biotechnology)**

Semester :**VI**

Objective of the course:

This course aims at imparting knowledge in fundamental aspects of spectroscopy in chemistry. To acquire basic knowledge in the specialized areas of chemistry. To train the students in various characterization techniques.

Course outcomes

Ability to define the various concepts of spectroscopy.

- The aim is to teach students the basic processes involved in NMR and mass spectrometry with different types of techniques.
- To enable the students to elucidate the structure of a compound numerically.