FACULTY OF SCIENCES

SYLLABUS FOR THE BATCH FROM THE YEAR 2023 TO YEAR 2026

Programme Code: BSBT

Programme Name: B.Sc. Biotechnology

(Semester I-IV)

Examinations: 2023-2026

Department of PG Department of Biotechnology

Khalsa College, Amritsar

S.No.	PROGRAMME OBJECTIVES
1.	To improve, broaden, and deepen the knowledge of the students in order to provide students with an adaptable, research-intensive curriculum that meet the needs of both academia and industry.
2.	Enhancing career opportunities in industry, research locally and internationally,or serving as a foundation for further higher education through, cutting-edge laboratory exposures and dissertation-related activities that develop students' global competencies.
3.	Fostering a value system among students in order to promote critical thinking and a thorough understanding of key bioethical concepts.
4.	To inculcate the ability to work as entrepreneurs and technologists with strong ethics and communication abilities.

S.No.	PROGRAMME SPECIFIC OUTCOMES (PSOS)
PSO-1	To gain knowledge through theory and practical.
PSO-2	To establish a solid foundation at the cellular, molecular, genetic, and metabolic levels.
PSO-3	To make agricultural practices more efficient through the use of plant tissue culture and recombinant DNA technology.
PSO-4	To gain understanding of biomolecules, including their formation and interaction.
PSO-5	To do research on microorganisms and strain improvement for industrial applications.
PSO-6	To instill safe laboratory practices and procedures.
PSO-7	To get knowledge on different techniques and the usage of laboratory instruments.

COURSE SCHEME											
SEMESTER – I											
Course Code	**Course Name**	**Hours/ Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
Major Courses											
BT-BTL111	Biochemistry-I (Biomolecules)	3	3	-	-	3	56	-	19	75	8-9
BT-BTP111	Biochemistry-I (Biomolecules) Lab	4	-	-	2	2	-	37	13	50	10-11
BT-BTL112	General Microbiology-I	3	3	-	-	3	56	-	19	75	12-13
BT-BTP112	General Microbiology-I Lab	4	-	-	2	2	-	37	13	50	14-15
BT-BTL113	Cell Biology	3	3	-	-	3	56	-	19	75	16-17
BT-BTP113	Cell Biology Lab	4	-	-	2	2		37	13	50	18-19
Minor Courses (If Any)											
CH-BTL114	Chemistry-I (Inorganic Chemistry)	3	2	1	-	3	56	-	19	75	21-22
CH-BTP114	Chemistry-I (Inorganic Chemistry) Lab	2	-	-	1	1	-	19	6	25	23
BO-BTL115	Botany-I	3	2	1	-	3	56	-	19	75	24-25
BO-BTP115	Botany-I Lab	2	-	-	1	1	-	19	6	25	26
Ability Enhancement Courses (Compulsory Courses)											
BCSE-1122	Communicative English-I	4	4	-	-	4	75	-	25	100	28-29
BHPB-1101 BPBI-1102 BPHC-1104	Punjabi Compulsory OR *Basic Punjabi OR **Punjab History & Culture	4	4	-	-	4	75	-	25	100	30-34
Value Added Courses											
ZDA-111	***Drug Abuse: Problem, Management and Prevention	2	2	0	0	2					36-37
Total		41	23	2	8	33	430	149	196	775	

Note:
1. *Special Paper in lieu of Punjabi Compulsory.
2. **For those students who are not domicile of Punjab
3. ***This paper marks will not be included in the total marks.
4. For theory one credit is equal to 1 hours and for practical one credit is equal to 2 hours.

SEMESTER – II											
Course Code	**Course Name**	**Hours/Week**	**Credits**			**Total Credits**	**Max Marks**				**Page No.**
			L	**T**	**P**		**Th**	**P**	**IA**	**Total**	
Major Courses											
BT-BTL121	Biochemistry-II (Bioenergetics and Enzymology)	3	3	-	-	3	56	-	19	75	39-40
BT-BTP121	Biochemistry-II (Bioenergetics and Enzymology) Lab	4	-	-	2	2	-	37	13	50	41-42
BT-BTL122	General Microbiology-II	3	3	-	-	3	56	-	19	75	43-44
BT-BTP122	General Microbiology-II Lab	4	-	-	2	2	-	37	13	50	45-46
BT-BTL123	Genetics	3	3	-	-	3	56	-	19	75	47-48
BT-BTP123	Genetics Lab	4	-	-	2	2	-	37	13	50	49-50
Minor Courses (If Any)											
ZO-BTL124	Zoology-I	3	2	1	-	3	56	-	19	75	52-53
ZO-BTP124	Zoology-ILab	2	-	-	1	1	-	19	6	25	54-55
MA-BTL125	Biomathematics & Biostatistics	3	2	1	-	3	56	-	19	75	56-57
Ability Enhancement Courses (Compulsory Courses)											
BCSE-1222	Communicative English-II	4	4	-	-	4	75	-	25	100	59-60
BHPB-1201 BPBI-1202 BPHC-1204	Punjabi Compulsory OR *Basic Punjabi OR **Punjab History & Culture	4	4	-	-	4	75	-	25	100	61-65
Value Added Courses											
ZDA-121	***Drug Abuse: Problem, Management and Prevention	2	2	-	-	2					67-68
Total		39	23	2	7	32	430	130	190	750	

Note:

1. *Special Paper in lieu of Punjabi Compulsory.
2. **For those students who are not domicile of Punjab
3. ***This paper marks will not be included in the total marks.
4. For theory one credit is equal to 1 hours and for practical one credit is equal to 2 hours.

COURSE SCHEME											
SEMESTER – III											
Course Code	Course Name	Hours/ Week	Credits			Total Credits	Max Marks				Page No.
			L	T	P		Th	P	IA	Total	
Major Courses											
BT-BTL231	Fundamentals of biotechnology	3	3	-	-	3	56	-	19	75	70-71
BT-BTP231	Fundamentals of biotechnology Lab	4	-	-	2	2	-	37	13	50	72
BT-BTL232	Immunology-I	3	3	-	-	3	56	-	19	75	73-74
BT-BTP232	Immunology-I Lab	4	-	-	2	2	-	37	13	50	75
BT-BTL233	Biochemistry-III (Metabolism of Carbohydrates and Lipids)	3	3	-	-	3	56	-	19	75	76-77
BT-BTP233	Biochemistry-III (Metabolism of Carbohydrates and lipids) Lab	4	-	-	2	2		37	13	50	78
BT-BTL234	Molecular Biology	3	3	-	-	3	56	-	19	75	79-80
BT-BTP234	Molecular Biology Lab	4	-	-	2	2		37	13	50	81
Minor Courses (If Any)											
CH-BTL235	Chemistry-II (Organic)	3	2	1	-	3	56	-	19	75	83-84
CH-BTP235	Chemistry-II (Organic) Lab	2	-	-	1	1	-	19	6	25	85
BO-BTL236	Botany-II	3	2	1	-	3	56	-	19	75	86-87
BO-BTP236	Botany-II Lab	2	-	-	1	1	-	19	6	25	88
Ability Enhancement Courses (Compulsory Courses)											
ESL-221	Environmental Studies-I (Compulsory Paper)	2	2	0	0	2				50	90-91
Total		40	18	2	10	30	336	186	178	700	

Note: ESL-221 Environmental Studies (Compulsory Paper) marks will not be included in the Total marks.

COURSE SCHEME											
SEMESTER – IV											
Course Code	Course Name	Hours/ Week	Credits			Total Credits	Max Marks				Page No.
			L	T	P		Th	P	IA	Total	
Major Courses											
BT-BTL241	Industrial Biotechnology-I	3	3	-	-	3	56	-	19	75	93-94
BT-BTP241	Industrial Biotechnology-I Lab	4	-	-	2	2	-	37	13	50	95
BT-BTL242	Immunology-II	3	3	-	-	3	56	-	19	75	96-97
BT-BTP242	Immunology-II Lab	4	-	-	2	2	-	37	13	50	98
BT-BTL243	Biochemistry-IV (Metabolism of Proteins and Nucleic acid)	3	3	-	-	3	56	-	19	75	99-100
BT-BTP243	Biochemistry-IV (Metabolism of Proteins and Nucleic Acid) Lab	4	-	-	2	2	-	37	13	50	101
BT-BTL244	Skill Development in Biotechnology	3	3	-	-	3	56	-	19	75	102-103
BT-BTP244	Skill Development in Biotechnology Lab	4	-	-	2	2	-	37	13	50	104
BT-BTL245	Fundamental of Bioinformatics	3	3	-	-	3	56	-	19	75	105-106
BT-BTP245	Fundamental of Bioinformatics Lab	4	-	-	2	2	-	37	13	50	107
BT-BTP246	*Industrial/Institutional Visit	4	-	-	2	2	-	50	-	50	108
ZO-BTL247	Zoology-II	3	2	1	-	3	56	-	19	75	110-111
ZO-BTP247	Zoology-II lab	2	-	-	1	1	-	19	6	25	112
Ability Enhancement Courses (Compulsory Courses)											
ESL-222	Environmental Studies-II (Compulsory Paper)	2	2	0	0	2				50	114-116
Total		46	19	1	13	33	336	254	185	775	

Note: ESL-222 Environmental Studies (Compulsory Paper) marks will not be included in theTotal marks.

* **BT-BTP246 -** *Industrial/Institutional Visit – No Internal Assessment

B.Sc. (BIO-TECHNOLOGY)
(SEMESTER-I)
Major Core Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)
BT-BTL-111
Biochemistry-I (Biomolecules)

Credit Hours : 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:
The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course objectives: Course contents are designed to enable students to learn:

1. Water as mother liquor of life, its properties, ionisation, relationship between pH and pKand cellular buffers.
2. Classification and properties of Carbohydrates, structure and function of disaccharides, Homo and Heteropolysaccharides Polysaccharides.
3. Classification and properties fatty acids, lipids, their structure and function.
4. Classification of amino acids, their chemical reactions, protein classification andstructural organization.

Course content

Section-A

Water and its Properties: Role of water in life, Structure of water molecules, Physico-chemical properties of water, Role of hydrogen bonding and non-covalent interactions in water, Dissociation and association constants, pH and buffers: Lowis concept of acids and bases, ionic product of water, pH scale, weak acids and bases, ionization of weak acids, titration of weak acids by strong base, pI, pka, Hasselbach Hendersson equation and its implications.

Section-B

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

Section-C

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

Section-D

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

Books Recommended

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7th ed,WH Freeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry, 9th Ed., WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters Kluwer India Pvt. Ltd.

Course Outcomes

Sr. No.	On completing the course, the students will be able to:
CO-1	Learn water- a unique element in this universe along with its utility and its role as an elixir of life on the earth.
CO-2	Get knowledge on 'Hydrates of Carbon' as mostimportant energy producing molecules with in the living cell along with their diverse roles
CO-3	Understand the compositional related role of Lipids as group of diverse molecules compiles under single term, present as the most prominent components of the biological membranes along with their physiological roles.
CO-4	Study apprehension about the composition and roles ofproteins as biological macromolecular functional units ofliving cell along with their structural hierarchy.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT-BTP111

Biochemistry-I (Biomolecules) Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment:13

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

Course objectives

Course contents are designed to enable students to

1. Understand the spectrum of light based upon different wavelengths.
2. Comprehend the laws governing the absorption of light by biomolecules.
3. Perform spectrophotometric investigations.
4. Know inside of the concept of acidity (pH), basicity (pOH) and ionisation in solutions as well as indicators.
5. Learn about the volumetric titrations.

Course content

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

Books Recommended

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7th ed,WH Freeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry, 9thEd., WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters KluwerIndia Pvt. Ltd.
4. J L Jain , Sunjay Jain , Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier

Course Outcomes

Sr. No.	On completing the course, the students will be able to:
CO-1	Study Spectrophotometric analysis viz. (Ultra violet andVisible) using spectrophotometer and colorimeter.
CO-2	Understand quantitative estimations of Protein by different methods based upon the amino acid composition.
CO-3	Study the carbohydrate content estimations and sample analysis for different types of sugars.
CO-4	Study quality characteristics analysis for fats viz. acid and saponification value.
CO-5	Study acid-base volumetric titrations along with PK determination.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)

BT-BTL112

General Microbiology-I

Credit Hours : 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To correlate the knowledge of fundamental Science‟s conceptual approach in the applied fields of Microbiology.
2: To make the pupils aware of the relation between Microbiology and Biotechnology.
3: The students made to learn all the realms of Microbiology (Mycology, Bacteriology, Virology etc.) in a comprehensive way.
4: The theoretical knowledge imparted by regular class work, assignments, class tests etc. will be further strengthened by use and application of ultra-modern instrumentation in world class labs to give first hand practical knowledge of Microbiology.
5: The students will be given exposure to latest happening in world around by arranging workshops, expert lectures by the intelligentsia from research/industry and academia.

Course Content

Section-A

Introduction to Microbiology- Need to study Microbiology. Historical Perspective and Important discoveries related to Microbiology. Relationship between Microbiology and Biotechnology. Tools and ntechniques in Microbiology and their applications in Biotechnology. The Microbial Biotechnology.General Features-Bacteria, Fungi, Neurospora, Yeast and Viruses.Microbes in extreme environments- the thermophiles, halophiles, acidophiles, psychrophiles and alkalophiles.

Section-B

Basic concept of Microbial growth. Concept of growth in batch culture and continuous culture. Microbial growth media and its composition and classification, Sterilization-Basic concept, physical and chemical methods of sterilization. Sterilization-Basicconcept, physical and chemical methods of sterilization.Bacterial nutrition-Introduction, Nutritional forms of bacteria, Basic concept of Transport mechanisms of nutrients across microbial cell membranes.

Section-C

Principles and application of bright field, dark field phase contrast, fluorescence & immunofluorescence, electron microscopy.Gram positive and Gram negative bacteria. Natureof the Microbial Cell Surface and Structure and anatomy of bacterial cell walls, Types of bacterial flagella. Different types of bacterial staining.

Section-D

Bacterial Classification: Bacterial classification and taxonomy based on Bergey‟s Manual of Determinative bacteriology–General outline only. An introduction to Bacterial Serotypes. Microbial culture collection centres, Methods of Microbial preservation. Discovery of penicillin, strain improovement programme of *Penicillium* sp. To obtain higher yield of penicillin.

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4th Edition,Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5th Edition,The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, London.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBS Publishers & Distributors.
7. Chander, M. And Puri, P. (2008). A Concise Course in Microbiology. Krishna Brothers Publishers, Old Railway Road, Jalandhar.
8. Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.

Course Outcome

Sr. No.	On completing the course, the students will beable to:
CO-1	Study the concepts of microbial biotechnology and general features of various micro-organisms, antibiotics.
CO-2	Study bacterial growth curves and batch cultures
CO-3	Learn the principle, working and design of various microscopes.
CO-4	Gain knowledge on role of microbes in food industry.
CO-5	Get themselves acquainted with microbes and know about fruits and fines coming from microbes.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)
BT-BTP112
General Microbiology-I Lab

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment:13

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

Course Objectives

1. To correlate the knowledge of the theoratical fields of Microbiology with practical.
2. To make the pupils aware of the role of Microbiology in daily life.
3. The students made to learn all the general features and identification of various microbes such as fungi, bacteria, virus etc.
4. To teach them microbiology practicals applicable in dairy, diagnostics and other industries.
5. The students will be given opportunity to perform each and every experiment, get results and infer upon their findings.

Course Content

1. Aseptic techniques of sterilization. Do and don't in microbiology lab.
2. Cleaning of glassware.
3. Preparation of media, cotton plugging and sterilization
4. Isolation of micro-organism from air, water and soil samples. Dilution and pour plating, Colony purification by streaking method.
5. Identification of bacteria by simple staining, negative staining and Gram staining.
6. Detection of specific bacteria by Wet mount preparation method and Hanging dropmount method.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (1999). Microbiology: A Laboratory Manual 4th Ed: Harlow, Addition-Wesley.
2. Dubey R.C. and Maheshwari (2012) Practical Microbiology 5th edition: S. Chand and company ltd.New Delhi.

Course Outcome

Sr. No.	On completing the course, the students will beable to:
CO-1	Become aware of role of microbes indaily life.
CO-2	Learn to maintain proper hygiene in day to day life.
CO-3	Have hands on experience of quality control testing in food, feed, diagnostic and water testingindustry.
CO-4	Learn planning and execution of theprocedure involved in a systematic way.
CO-5	Learn ethics of working and team spirit.

B.Sc. Biotechnology (Semester-I)BT-BTL113
Cell Biology

Credit Hours : 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:
The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To make students understand the concept of cell as the basic entity of livingsystems and the level of organization from cell to organism.
2. To elaborate the concept of cell theory. Students will learn the characteristics ofdifferent cells: PPLO‟s, bacteria, eukaryotic microbes, plant and animal cells
3. To make students understand the structural organization of cell and function ofdifferent organelles.
4. Students will become aware how Cell Division takes place and learn aboutdifferent stages of Cell Cycle, Cell-cell interaction, Cell locomotion
5. To make students aware of Biological Membranes, their supramolecular architecture, Solute transport; Model membranes and Liposomes.

Course content

Section-A

Cell as a basic unit of living systems. The cell theory Broad Classification of Cell Types:PPLO‟s, bacteria, eukaryotic microbes, plant and animal cells. A detailed classification of cell types within an organism. Cell, tissue, organ and organism as different levels of organizations of otherwise genetically similar cells.

Section-B

Structure and function of cell organelles, ultrastructure of cell membrane, cytosol, Golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.), Mitochondria, chloroplasts, lysosomes, peroxisomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

Section-C

Cell Division and Cell Cycle: mitosis, meiosis, stages of cell cycle, binary fission,amitosis and its regulation. Cell-cell interaction Cell locomotion (amoeboid, flagellar and ciliar).

Section-D

Biological Membranes: Supramolecular architecture of membranes; Solute transportacross membranes; Model membranes and Liposomes.

Books Recommended:

1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (1991) Cell and MolecularBiology, Saunders, Philadelphia.
2. Lodish, H., Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P. and Darnell,J. (1995).
3. Molecular Cell Biology 3rd Edition, Scientific American Books Inc.
4. Geoffrey, M. (2000). The Cell: A molecular approach 2nd Edition, ASM Press.

Course Outcome

Sr. No.	On completing the course, the students will beable to:
CO-1	Learn about the Cell andthe projections about the origin of the cell along with the key features of The Cell theory. Students will be able to differentiate prokaryotic and eukaryotic cells in details
CO-2	Learn about the structural details and the functional organization of the cell; ultrastructure of cell membranes
CO-3	Learn about the structure and function of cell organelles (cytosol, Golgi bodies,endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.), Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).
CO-4	Understand the concept of Cell Division and Cell Cycle , Cell-cell interaction Celllocomotion (amoeboid, flagellar and ciliar)
CO-5	Gain knowledge about biological Membranes, supramolecular architecture and solute transport across membranes; Modelmembranes and Liposomes.

B.Sc. Biotechnology (Semester-I)BT-BTP113
Cell Biology Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment:13

Course Objectives

1. To enable students to differentiate Prokaryotic and Eukaryotic cells
2. To enable Students study electron micrographs of various cell organelles
3. To enable students to prepare and study Permanent Slides:
4. To enable students to perform microscopic examination of Buccal Smear, Barrbody
5. To enable students prepare Plant Tissue specimens by microtomy

Course content

1. Study of Cells:

(a) Prokaryotic cells: Lactobacillus, E. coli. Blue green algae.
(b) Eukaryotic cells: Testicular material (for studies of spermatogenesis)

2. Study of electron micrographs of various cell organelles-plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic Reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids, etc.
3. Preparation of Permanent Slides: Principles and procedures- Section cutting of tissues and staining of tissues with Haematoxylin/eosin method.
4. Study of permanent slides of various tissues (gut region, liver, lung, spleen,kidney, pancreas, testis, ovary, tongue, skin etc.).
5. Preparation of Buccal Smear for microscopic examination.
6. Barr body observation in human squamous epithelial cells.
7. Microtomy of Plant Tissue specimens (Stem & Root)

Books Recommended:

1. Shah, V.C., Bhatavdekar, J., Chinoy, N.J. and Murthy, S.K. (1988). Essential techniques in Cell Biology.Anand Book Depot, Ahemadabad.

Celis, J.E. (1998) Cell Biology: A Laboratory handbook. Vol. 1-3. AcademicPress, UK.

Course Outcome

Sr. No.	On completing the course, the students will be able to:
CO-1	Define the characteristics and differentiate Prokaryoticcells (Lactobacillus, E. coli. Blue green algae) from Eukaryotic cells; Testicular material (for studies of spermatogenesis)
CO-2	Identify the electron micrographs of various cell organelles like plasma membrane, Mitochondria,Golgi complex, Lysosomes, Endoplasmic Reticulum(smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids, etc.
CO-3	Perform section cutting of tissues and learn staining methods (Haematoxylin/eosin method) of tissues for the preparation of permanent slides, identify permanent slides of various tissues (gut region, liver, lung, spleen, kidney, pancreas,testis, ovary, tongue, skin etc.).
CO-4	Handle the preparation and microscopic examination of Buccal Smear, observe Barr body in human squamous epithelial cells.
CO-5	Perform microtomy of Plant Tissue specimens

Minor Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)
CH-BTL114
Chemistry-I (Inorganic Chemistry)

L T
Credit Hours : 2+1=3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:
The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course objectives

1. Coordination complexes, wernier theory, optical geometrical isomerism.
2. Valence bond theory based formation of complexes. Factors affecting stability of metal complexes, crown ethers, cryptands, podants like macrocyclic ligands.
3. Crystal field theory, high spin, low spin complexes, CFSE calculation, determination ofterm symbols of metal complexes.

Course content

Section-A

Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12. Factors affecting co-ordination numbers and stereo-chemistry,Isomerism in coordination compounds.

Section-B

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, electro-neutrality and back bonding, limitations of V.B. theory.

Section-C

Stability of co-ordination compounds, Introduction Factors affecting the stability of metal ion complexes with general ligands, Alkali metal and alkaline earth metal chelators : Definition and few examples of macrocyclic ligands, macrocyclic effect, crown ethers & cryptands.

Section-D

Crystal field theory- Spliting of d-orbitals in octahedral, tetrahedral, cubic and square planer fieldsof ligands, calculations of C.F.S.E. in high spin and low spin octahedral and high spin tetrahedral complexes, factors affecting the 10 Dq value.
Spectroscopic terms for d^1-d^2 electronic configurations.

Books Recommended

1. G.L. Eichorn, Inorganic Biochemistry, Vol. I Elsevier,
2. J.E. Huheey, E.A. Keiter, R.L. Keiter, Inorganic Chemistry, 4th ed. Pearson Education, Singapore, 1999.
3. D.F.C Shriver, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS Oxford, 1991.
4. Cowan, J.A. (1997) – Inorganic Biochemistry – An Introduction, Wiley- VCH

Course outcomes

Sr. No.	On completing the course, the students will beable to:
CO-1	Learn about Werner's theory, isomerism in coordination compounds, valence bond theory oftransition metal complexes.
CO-2	Learn about various theories like VBT, CFT for explain the bonding in co-ordination complexes.
CO-3	Understand the splitting pattern of d-orbitals under different geomateries and factor effecting splitting of orbitals.
CO-4	Derive spectroscopic terms of various configurations
CO-5	Learn about crown ethers, cryptands ,macrocyclic ligands and their applications

CH-BTP114
Chemistry-I (Inorganic Chemistry) Lab

Credit Hours : 1
Maximum Marks: 25
Theory: 19
Internal Assessment: 06

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

Course objectives
Students will understand
1. How to calculate normality, strength of unknown solutions through volumetric titration, and determine hardness of water by performing complexometric titration,
2. Able to find out Acid, Basic radicals or Cation and Anion from the mixture of Inorganicsalts.

Course content

Volumetric Analysis:

Iodimetry, Iodometry, Redox titrations using $K_2Cr_2O_7$ and KM_nO_4.

Complexometric titration using EDTA Ca^{2+}, Mg^{2+}: in context with study of hardness of water.

Inorganic qualitative analysis:

Four ions (Two cations two anions).

A. Preliminary tests: Physical examination, Dry heating test, charcoal cavity test,$Co(NO_3)_2$ test, flame test, borax bead test.

B. Acid radical analysis: metal ions

Course outcomes

Sr. No.	**On completing the course, the students will beable to:**
CO-1	Perform volumetric analysis through, iodometric and redox titrations and study their utility.
CO-2	Carry out water analysis for its hardness and amount of dipositive ion present.
CO-3	Perform the preliminaryanalysis on the mixture of two salts.
CO-4	Learn to identify cations and anions in the mixture

B.Sc (BIOTECHNOLOGY) SEMESTER–I

BO-BTL115
Botany-I

L T

Credit Hours : 2+1=3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To study the plant diversification and their different groups.
2. To study the internal structure (anatomy) of plants (root, stem and leaf).
3. The study the concept of reproduction (vegetative and sexual) in floweringplants.
4. To study the plant identification, botanical descriptions and classification offlowering plants

Section-A

Diversity in plants: General characters of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. Concepts of species and hierarchical taxa, biological nomenclature.

Section-B

Anatomy of flowering plants: Meristems, simple and complex permanent tissues, internal structure of stem, root and leaf, secondary growth in stem and root of *Helianthus*.

Section-C

Reproduction in flowering plants: Structure and development of anther and malegametophyte, Structure and development of ovule and female gametophyte; Pollination (self and cross) and fertilization; structure and function of endosperm and embryo (dicot and monocot), polyembryony, self-incompatibility.

Section-D

Taxonomy of flowering plants: Artificial (Linnaeus), natural (Bentham & Hooker) and phylogenetic (Engler and Prantl) systems of classification; Terminology pertaining to floral description, General characteristics (including economic importance) of following families of angiosperms; giving examples of few important genera: Solanaceae: *Solanum/Petunia*, Rutaceae: *Citrus*, *Murraya*, Cruciferae- *Brassica*, Apiaceae (Umbelliferae) – *Coriander*, Asteraceae - *Helianthus*, Leguminosae –*Cassia*/*Acacia/Sweet pea*, Poaceae (Graminae)- *Triticum*

Books Recommended

1. Dickison, W.C. (2000). Integrative Plant Anatomy. Academic Press, California, USA.
2. Raven, P.H., Evert, R.F. and Eichhorn, S.E. (1999). Biology of Plants, 5th edition. W.H.Freeman and Co., Worth Publishers, New York.
3. Rudall, P. J. (2007). Anatomy of Flowering Plants: An Introduction to Structure andDevelopment (3rd Edition). Cambridge University Press, UK.
4. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
5. Hartmann, H.T. and Kestler, D.E. (1976). Plant Propagation: Principles and Practices, 3rd edition, Prentice Hall of India Pvt. Ltd., New Delhi.
6. Vashistha, P. C. (2016). Botany for degree students. S. Chand and Company, New Delhi

Course Outcomes

Sr. No.	On completing the course, the students will beable to:
CO-1	Understand the diversity of plant kingdom
CO-2	Learn morphology and anatomy of plants
CO-3	Understand the process of reproduction and the development of reproductive organs in flowering plants
CO-4	Learn different systems of classification of plants
CO-5	Learn different terminologies pertaining to floraldescription
CO-6	Understand the economic importance of plantsbelonging to different families

B.Sc (BIOTECHNOLOGY) SEMESTER–I

BO-BTP-115

Botany –I Lab

Credit Hours : 1
Maximum Marks: 25
Practical: 19
Internal Assessment: 6

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

Course objectives

1. To study micro and megasporogenesis and female gametophytes and endosperms.
2. To study the internal structure (anatomy) of plants (root, stem and leaf).
3. The study floral diagram and floral formula of different flowers.
4. To study botanical descriptions and classification of flowering plants

Course content

Plant Anatomy: Anatomical studies of stem, root and leaf in *Helianthus* and maize plant.

Embryology: Study of the permanent slides pertaining to micro and megasporogenesis and female gametophytes and endosperms.

Taxonomy:

a) Description of flowers including floral diagram, floral formula, V.S. of flower of the representative genera of families mentioned in syllabus.
b) Identification and short morphological economic note on the specimens included in Unit IVof the theory paper

Course Outcomes

Sr. No.	On completing the course, the students will beable to:
CO-1	Learn different terminologies pertaining todescription of flowers
CO-2	Learn anatomy of plants
CO-3	Understand the process of micro and megaspore genesis and female gametophytes andendosperms

Ability Enhancement Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-I)
BCSE-1122 COMMUNICATION
SKILLS IN ENGLISH-I

L	T	P	Credits
3	0	1	4

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 15
Internal Assessment: 25

Suggested Pattern of Question Paper:

The question paper will be divided into two sections. Section A will consist of Twelve (12) questions of One (1) mark each. Section B will consist of Six questions of Eight (8) marks each. There will be internal choice wherever possible.

Section A

1. Do as directed
   Articles, Conjunctions and Prepositions (12X1=12 Marks)

Section B

1. Reading Skills: Reading Tactics and strategies; Reading purposes–kinds of purposes; Reading for direct meanings.
2. Comprehension questions of an unseen passage
3. Personal letter and Official/Business letters
4. Writing notices/agenda/minutes for public circulation on topics of professional interest.
5. Writing resume or converting a biographical note into resume
6. Translation from English to Vernacular (Punjabi/ Hindi) (Isolated Sentences) (6X8=48 Marks)

Course Objectives:

I: To develop competence in written communication.
II: To inculcate innovative and critical thinking among the students.
III: To enable them to grasp the application of communication theories.
IV: To acquire knowledge of the latest technology related to communication skills.
V: To provide knowledge of multifarious opportunities in the field of this programme.

Course Contents:

1. Reading Skills: Reading tactics and strategies; Reading purposes–kinds of purposes and associated comprehension; Reading for direct meanings; Reading for understanding concepts, details, coherence, logical progression and meanings of phrases/ expressions.

Activities:

a) Active reading of passages on general topics
b) Reading newspaper, articles, editorials etc.
c) Short questions based on content and development of ideas of a given paragraph.

2. Writing Skills: Guidelines for effective writing; writing styles for application, resume, personal letter, official/ business letter, memo, notices etc.

Activities:

a) Personal and business letters.
b) Converting a biographical note into a sequenced resume.
c) Writing notices for circulation/ boards.
d) Making notes of given passage with headings and sub-headings
e) Writing newspaper reports based on given heading.

Recommended Books:

1. *Oxford Guide to Effective Writing and Speaking* by John Seely.
2. *The Written Word* by Vandana R Singh, Oxford University Press.
3. *Murphy's English Grammar* (by Raymond Murphy) CUP.

Course Outcomes:

The completion of this course enables students to:

1. Identify common errors in language and rectify them.
2. Develop and expand writing skills through controlled and guided activities.
3. Develop coherence, cohesion and competence in written discourse through intelligible pronunciation.
4. Develop the ability to handle the interview process confidently and learn the subtle nuances of an effective group discourse.
5. Communicate contextually in specific and professional situations with courtesy.

PRACTICAL (Marks: 15)

Course Contents:-

1. Reading dialogues (5 Marks)
2. Rapid reading (5 Marks)
3. Project File (5 Marks)

B. Sc. Hons. (Physics, Chemistry, Maths), B. Sc. Bio Tech./ IT/ Fashion Designing/ Food Sc., B. A. JMC, BCA, B.Sc. in Computational Statistics and Data Analytics, B.Sc. Artificial Intelligence and Data Science, Bachelor of Vocational (B.Voc.) (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology, Renewable Energy Techology)

Semester-I

Compulsory Course

ਲਾਜ਼ਮੀ ਪੰਜਾਬੀ

Credit & Marks Distribution, Eligibility and Pre-Requisites of the Course

Course title & Code	Total Teaching Hours	Total Credits/ Hours per week	Credit distribution			Total Marks 100		Time Allowed in Exam	Eligibility criteria	Pre-requisite of the course (if any)
			L	T	P	Theory	IA			
ਲਾਜ਼ਮੀ ਪੰਜਾਬੀ BHPB-1101	60	4	4	0	0	75	25	3 Hours	Class 12th pass in any stream	Studied Punjabi up to 10th Standard

ਕੋਰਸ ਦਾ ਉਦੇਸ਼ Course Objective	**ਪਾਠ-ਕ੍ਰਮ ਨਤੀਜੇ Course Outcomes (COs)**
▪ ਵਿਦਿਆਰਥੀਆਂ ਵਿਚ ਸਾਹਿਤਕ ਰੁਚੀਆਂ ਪੈਦਾ ਕਰਨਾ। ▪ ਆਲੋਚਨਾਤਮਕ ਰੁਚੀਆਂ ਵਿਕਸਤ ਕਰਨਾ। ▪ ਮਾਤ ਭਾਸ਼ਾ ਦੀ ਸਮਝ ਨੂੰ ਵਿਕਸਤ ਕਰਨਾ।	▪ ਉਸ ਵਿਚ ਸਾਹਿਤ ਰੁਚੀਆਂ ਵਿਕਸਤ ਹੋਣਗੀਆਂ। ▪ ਉਸ ਵਿਚ ਸਾਹਿਤ ਸਿਰਜਣਾ ਦੀ ਸੰਭਾਵਨਾ ਵਧੇਗੀ। ▪ ਉਸ ਵਿਚ ਕਿਸੇ ਵੀ ਵਿਸ਼ੇ ਦਾ ਗਹਿਨ ਅਧਿਐਨ ਕਰਨ ਦਾ ਬੋਧ ਹੋਵੇਗਾ। ▪ ਉਹ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ ਬਾਰੇ ਗਿਆਨ ਹਾਸਲ ਕਰਨਗੇ

ਅੰਕ-ਵੰਡ ਅਤੇ ਪ੍ਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

ਸਿਲੇਬਸ ਦੇ ਚਾਰ ਭਾਗ ਹਨ ਪਰ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੇ ਪੰਜ ਭਾਗ ਹੋਣਗੇ। ਪਹਿਲੇ ਭਾਗ ਵਿਚ 1.5-1.5 (ਡੇਢ-ਡੇਢ) ਅੰਕ ਦੇ ਅਤਿ-ਸੰਖੇਪ (Objective Type) 10 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜੋ ਕਿ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਹੋਣਗੇ ਅਤੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹੋਣਗੇ। ਸਿਲੇਬਸ ਦੇ ਬਾਕੀ ਚਾਰ ਭਾਗਾਂ ਵਿਚ 02-02 ਲੇਖ ਨੁਮਾ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰੇਕ ਭਾਗ ਵਿਚੋਂ 01-01 ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੋਵੇਗਾ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 15 ਅੰਕ ਹੋਣਗੇ। ਪੇਪਰ ਸੈੱਟਰ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ 25 ਅੰਕਾਂ ਦੀ ਹੈ। ਇਸ ਪੇਪਰ ਦੇ ਕੁੱਲ ਅੰਕ 75+25=100 ਹਨ।

ਪਾਠ-ਕ੍ਰਮ

ਭਾਗ-ਪਹਿਲਾ

ਸਾਹਿਤ ਦੇ ਰੰਗ, ਡਾ. ਮਹਿਲ ਸਿੰਘ (ਸੰਪਾ.), ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
ਭਾਗ ਪਹਿਲਾ - ਕਵਿਤਾ ਅਤੇ ਕਹਾਣੀ, ਡਾ. ਮਹਿਲ ਸਿੰਘ ਅਤੇ ਡਾ. ਆਤਮ ਰੰਧਾਵਾ (ਸਹਿ ਸੰਪਾ.)
(ਕਵਿਤਾ ਭਾਗ ਵਿਚੋਂ ਪ੍ਰਸੰਗ ਸਹਿਤ ਵਿਆਖਿਆ/ਵਿਸ਼ਾ-ਵਸਤੂ। ਕਹਾਣੀ ਭਾਗ ਵਿਚੋਂ ਸਾਰ/ਵਿਸ਼ਾ-ਵਸਤੂ)

ਭਾਗ-ਦੂਜਾ

ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ (ਸੰਪਾ. ਬਲਵੰਤ ਗਾਰਗੀ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
(ਅੰਮ੍ਰਿਤਾ ਸ਼ੇਰਗਿੱਲ ਤੋਂ ਭਾਈ ਸਮੁੰਦ ਸਿੰਘ ਤਕ)
(ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ/ਨਾਇਕ ਬਿੰਬ)

ਭਾਗ-ਤੀਜਾ

(ੳ) ਪੈਰ੍ਹਾ ਰਚਨਾ (ਤਿੰਨਾਂ ਵਿਚੋਂ ਇਕ)
(ਅ) ਪੈਰ੍ਹਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ

ਭਾਗ-ਚੌਥਾ

(ੳ) ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ: ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪ-ਭਾਸ਼ਾ ਵਿਚਲਾ ਅੰਤਰ,
ਪੰਜਾਬੀ ਉਪ-ਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ-ਚਿੰਨ੍ਹ।
(ਅ) ਪੰਜਾਬੀ ਭਾਸ਼ਾ: ਨਿਕਾਸ ਤੇ ਵਿਕਾਸ।

B. Sc. Hons. (Physics, Chemistry, Maths), B. Sc. Bio Tech./ IT/ Fashion Designing/ Food Sc., B. A. JMC, BCA, B.Sc. in Computational Statistics and Data Analytics, B.Sc. Artificial Intelligence and Data Science, Bachelor of Vocational (B.Voc.) (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology, Renewable Energy Techology)

Semester-I

Compulsory Course

ਮੁਢਲੀ ਪੰਜਾਬੀ

(In Lieu of Compulsory Punjabi)

Credit & Marks Distribution, Eligibility and Pre-Requisites of the Course

Course title &Code	Total Teaching Hours	Total Credits/ Hours per week	Credit distribution			Total Marks 100		Time Allowed in Exam	Eligibility criteria	Pre- requisite of the course (if any)
			L	T	P	Theory	IA			
ਮੁਢਲੀ ਪੰਜਾਬੀ BPBI-1102	60	4	4	0	0	75	25	3 Hours	Class 12th pass in any stream	NOT Studied Punjabi up to 10th Standard

ਕੋਰਸ ਦਾ ਉਦੇਸ਼ Course Objective	**ਪਾਠ-ਕ੍ਰਮ ਨਤੀਜੇ Course Outcomes (COs)**
• ਵਿਦਿਆਰਥੀ ਨੂੰ ਗੁਰਮੁਖੀ ਲਿਪੀ ਤੋਂ ਜਾਣੂ ਕਰਾਉਣਾ। • ਵਿਦਿਆਰਥੀ ਨੂੰ ਸ਼ੁੱਧ ਪੰਜਾਬੀ ਪੜ੍ਹਨਾ-ਲਿਖਣਾ ਸਿਖਾਉਣਾ। • ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੀਆਂ ਵਿਆਕਰਨਕ ਬਾਰੀਕੀਆਂ ਤੋਂ ਜਾਣੂ ਕਰਾਉਣਾ। • ਸ਼ੁੱਧ ਸੰਚਾਰ ਨੂੰ ਵਿਕਸਤ ਕਰਨਾ।	• ਵਿਦਿਆਰਥੀ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਅਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ ਦੀ ਸਿਖਲਾਈ ਵਿਚ ਮੁਹਾਰਤ ਹਾਸਲ ਕਰਨਗੇ। • ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਵਿਚ ਮੁਹਾਰਨੀ, ਲਗਾਂ-ਮਾਤਰਾਂ, ਸਵਰ ਅਤੇ ਵਿਅੰਜਨ ਅੱਖਰਾਂ ਦੀ ਪਛਾਣ ਅਤੇ ਵਰਤੋਂ ਸੰਬੰਧੀ ਸਮਝ ਵਿਕਸਿਤ ਹੋਵੇਗੀ। • ਵਿਦਿਆਰਥੀ ਸ਼ੁੱਧ ਪੰਜਾਬੀ ਲਿਖਣ-ਪੜ੍ਹਨ ਦੇ ਸਮਰੱਥ ਹੋਣਗੇ। • ਉਹ ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਸ਼ੁੱਧ ਰੂਪਾਂ ਦੀ ਜਾਣਕਾਰੀ ਹਾਸਲ ਕਰਨਗੇ।

ਅੰਕ-ਵੰਡ ਅਤੇ ਪ੍ਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

ਸਿਲੇਬਸ ਦੇ ਚਾਰ ਭਾਗ ਹਨ ਪਰ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੇ ਪੰਜ ਭਾਗ ਹੋਣਗੇ। ਪਹਿਲੇ ਭਾਗ ਵਿਚ 01-01 ਅੰਕ ਦੇ ਅਤਿ-ਸੰਖੇਪ ਉੱਤਰ ਵਾਲੇ (Objective Type) 11 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜੋ ਕਿ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਹੋਣਗੇ ਅਤੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹੋਣਗੇ। ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਦੂਸਰੇ ਭਾਗ ਵਿਚ, ਸਿਲੇਬਸ ਦੇ ਪਹਿਲੇ ਭਾਗ ਵਿਚੋਂ ਤਿੰਨ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਕੋਈ ਦੋ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 8-8 ਅੰਕ ਹੋਣਗੇ। ਇਸੇ ਤਰ੍ਹਾਂ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਤੀਸਰੇ ਭਾਗ ਵਿਚ ਤਿੰਨ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 8-8 ਅੰਕ ਹੋਣਗੇ। ਭਾਗ ਚੌਥੇ ਵਿਚ ਪੰਜ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਚਾਰ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 4-4 ਅੰਕ ਹੋਣਗੇ। ਭਾਗ ਪੰਜਵੇਂ ਵਿਚ ਦਸ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ 8 ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹੋਣਗੇ। ਹਰ ਪ੍ਰਸ਼ਨ ਦੇ 2-2 ਅੰਕ ਹੋਣਗੇ।

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ 25 ਅੰਕਾਂ ਦੀ ਹੈ। ਇਸ ਪੇਪਰ ਦੇ ਕੁੱਲ ਅੰਕ 75+25=100 ਹਨ।

ਪਾਠ-ਕ੍ਰਮ

ਭਾਗ-ਪਹਿਲਾ

(ੳ) ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਤੇ ਗੁਰਮੁਖੀ ਲਿਪੀ:

ਨਾਮਕਰਣ ਤੇ ਸੰਖੇਪ ਜਾਣ-ਪਛਾਣ: ਗੁਰਮੁਖੀ ਵਰਣਮਾਲਾ, ਅੱਖਰ ਕ੍ਰਮ, ਸਵਰ ਵਾਹਕ (ਓ, ਅ, ੲ), ਲਗਾਂ-ਮਾਤਰਾਂ, ਪੈਰ ਵਿਚ ਬਿੰਦੀ ਵਾਲੇ ਵਰਨ, ਪੈਰ ਵਿਚ ਪੈਣ ਵਾਲੇ ਵਰਨ, ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ

(ਅ) ਸਿਖਲਾਈ ਤੇ ਅਭਿਆਸ

ਭਾਗ-ਦੂਜਾ

ਗੁਰਮੁਖੀ ਆਰਥੋਗਰਾਫੀ ਅਤੇ ਉਚਾਰਨ:

ਸਵਰ, ਵਿਅੰਜਨ: ਮੁਢਲੀ ਜਾਣ-ਪਛਾਣ ਅਤੇ ਉਚਾਰਨ, ਮੁਹਾਰਨੀ, ਲਗਾਂ-ਮਾਤਰਾਂ ਦੀ ਪਛਾਣ

ਭਾਗ–ਤੀਜਾ

ਪੰਜਾਬੀ ਸ਼ਬਦ–ਜੋੜ: ਮੁਕਤਾ (ਦੋ ਅੱਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਤਿੰਨ ਅੱਖਰਾਂ ਵਾਲੇ ਸ਼ਬਦ), ਸਿਹਾਰੀ ਵਾਲੇ ਸ਼ਬਦ, ਬਿਹਾਰੀ ਵਾਲੇ ਸ਼ਬਦ, ਔਂਕੜ ਵਾਲੇ ਸ਼ਬਦ, ਦੁਲੈਂਕੜ ਵਾਲੇ ਸ਼ਬਦ, ਲਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਦੁਲਾਵਾਂ ਵਾਲੇ ਸ਼ਬਦ, ਹੋੜੇ ਵਾਲੇ ਸ਼ਬਦ, ਕਨੌੜੇ ਵਾਲੇ ਸ਼ਬਦ, ਲਗਾਖਰ (ਬਿੰਦੀ, ਟਿੱਪੀ, ਅੱਧਕ) ਵਾਲੇ ਸ਼ਬਦ

ਭਾਗ–ਚੌਥਾ

ਸ਼ੁੱਧ–ਅਸ਼ੁੱਧ ਸ਼ਬਦ

SEMESTER–I

PUNJAB HISTORY & CULTURE (From Earliest Times to C 320 BC)
(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)
Course Code: BPHC-1104

Credit: 04
L- T- P
04-0-0

Time: 3 Hours

Total Marks: 100
Theory: 75
Internal Assessment: 25

Instructions for the Paper Setters:

Question paper should consist of two sections—Section A and Section B. The paper setter must ensure that questions in Section–A do not cover more than one point, and questions in Section–B should cover at least 50 per cent of the theme.

Section–A: The examiner will set 15 objective type questions out of which the candidate shall attempt any 10 questions, each carrying 1½ marks. The total weightage of this section will be 15 marks. Answer to each question should be in approximately one to two sentences.

Section–B: The examiner will set 8 questions, two from each Unit. The candidate will attempt 4 questions selecting one from each Unit in about 1000 words. Each question will carry 15 marks. The total weightage of this section will be 60 marks.

Note: **The examiner is to set the question paper in two languages: English & Hindi.**

Course Objectives: The main objective of this course is to educate the history and culture of the Ancient Punjab to the students who are not domicile of the Punjab. It aims to familiarize these students with the physical features of ancient Punjab and its impact on its history and culture. It also provides them information about the different sources to construct the history and culture of the ancient Punjab. The course intends to provide knowledge of social, economic, religious life of the Harappan civilization, Indo-Aryans, teachings and impact of Jainism and Buddhism in the Punjab.

Unit-I

1. Physical features of the Punjab and impact on history.
2. Sources of the ancient history of Punjab.

Unit-II

3. Harappan Civilization: Town planning; social, economic andreligious life of the Indus Valley People.
4. The Indo-Aryans: Original home and settlement in Punjab.

Unit-III

5. Social, Religious and Economic life during Rig Vedic Age.
6. Social, Religious and Economic life during later Vedic Age.

Unit-IV

7. Teachings and impact of Buddhism.
8. Jainism in the Punjab.

Suggested Readings:-

L. Joshi (ed), *History and Culture of the Punjab*, Art-I, Patiala, 1989 (3rd edition)

L.M. Joshi and Fauja Singh (ed*), History of Punjab*, Vol. I, Patiala 1977.

Budha Parkash, *Glimpses of Ancient Punjab*, Patiala, 1983.

B.N. Sharma, *Life in Northern India*, Delhi. 1966.

Course Outcomes:

On Completing the Course, the Students will be able to:

CO-1 Learn the history and culture of the Ancient Punjab.
CO-2 Study the physical features of ancient Punjab.
CO-3 Understand about the sources of the history of the Punjab.
CO-4 Analyse the social, economic, religious life of the Harappan civilization and Vedic-Aryans.
CO-5 Learn the teachings and impact of Jainism and Buddhism in the Punjab.

Value Added Courses

SEMESTER–I

Course Code: ZDA111

Course Title- Drug Abuse: Problem, Management and Prevention

PROBLEM OF DRUG ABUSE

(Compulsory for all Under Graduate Classes)

Credit hrs./wk.:2

Time: 3 Hours Max. Marks: 50

Instructions for the Paper Setters:

1) There will be a total of 9 questions of which 5 are to be attempted.
2) Question 1 is compulsory and having 10 short answer type questions (1 mark each).
3) The remaining 8 questions (10 marks each) shall include 2 questions from each unit. Candidates shall be required to attempt 4 questions, one from each unit. Preferably, the question should not be split into more than two sub-parts.

Course Objectives- The course aims to:

CO-1.	Generate the awareness against drug abuse.
CO-2.	Describe a variety of models and theories of addiction and other problems related to substance abuse.
CO-3.	Describe the behavioral, psychological, physical health and social impact of psychoactive substances.
CO-4.	Provide culturally relevant formal and informal education programs that raise awareness and support for substance abuse prevention and the recovery process.
CO-5.	Describe factors that increase likelihood for an individual, community or group to be at risk of substance use disorders.

UNIT–I

- **Meaning of Drug Abuse**
  Meaning of drug abuse
  Nature and Extent of Drug Abuse: State and National Scenario

UNIT-II

- **Consequences of Drug Abuse for**
  Individual: Education, Employment, Income.
  Family : Violence.
  Society : Crime.
  Nation : Law and Order problem.

UNIT-III

- **Management of Drug Abuse**
  Medical Management: Medication for treatment of different types of drug abuses.
  Medication to reduce withdrawal effects.

UNIT-IV

- Psychiatric Management: Counseling, Behavioral and Cognitive therapy.
- Social Management: Family, Group therapy and Environmental Intervention.

References:

1. Ahuja, Ram (2003), Social Problems in India, Rawat Publication, Jaipur.
2. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
3. Inciardi, J.A. 1981. The Drug Crime Connection. Beverly Hills: Sage Publications. 23
4. Jasjit Kaur Randhawa & Samreet Randhawa, "Drug Abuse-Problem, Management & Prevention", KLS, ISBN No. 978-81-936570-6-5, (2018).
5. Jasjit Kaur Randhawa & Samreet Randhawa, "Drug Abuse Problem, Management & Prevention", KLS, ISBN No. 978-81-936570-8-9, (2019).
6. Jasjit Kaur Randhawa & Samreet Randhawa, "voZrI d[otos'A^(BPky'oh) ;wZf;nk, gqpzXB ns/o'eEkw", KLS, ISBN No. 978-81-936570-7-1, (2018).
7. Jasjit Kaur Randhawa, "Drug Abuse -Management & Prevention", KLS, ISBN No. 978-93-81278-80-2, (2018).
8. Kapoor. T. (1985) Drug epidemic among Indian Youth, New Delhi: Mittal Pub.
9. Modi, Ishwar and Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.
10. National Household Survey of Alcohol and Drug abuse. (2003) New Delhi, Clinical Epidemiological Unit, All India Institute of Medical Sciences, 2004.
11. Rama Gandotra & Jasjit Kaur Randhawa, "voZrI d[otos'A^(BPky'oh) gqpzXB ns/ o'eEkw", KLS, ISBN No. 978-93-81278-87-1, (2018).
12. Sain, Bhim 1991, Drug Addiction Alcoholism, Smoking obscenity New Delhi: Mittal Publications.
13. Sandhu, Ranvinder Singh, 2009, Drug Addiction in Punjab: A Sociological Study. Amritsar. Guru Nanak Dev University.
14. Singh, C. P. 2000. Alcohol and Dependence among Industrial Workers: Delhi: Shipra.
15. Sussman, S and Ames, S.L. (2008). Drug Abuse: Concepts, Prevention and Cessation, Cambridge University Press.
16. World Drug Report 2010, United Nations office of Drug and Crime.
17. World Drug Report 2011, United Nations office of Drug and Crime.

Course Outcomes:

The students will be able:

CO-1.	To describe issues of cultural identity, ethnic background, age and gender in prevention, treatment and recovery.
CO-2.	To describe warning sign, symptoms, and the course of substance use disorders.
CO-3.	To describe principles and philosophy of prevention, treatment and recovery.
CO-4.	To describe current and evidenced-based approaches practiced in the field of drug addiction.

B.Sc. (BIO-TECHNOLOGY)
(SEMESTER-II)
Major Core Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT-BTL123

Biochemistry-II (Bioenergetics and Enzymology)

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course objectives

Course contents are designed to enable students to

1. Understand the laws governing energy relationships in metabolic conversions with in theliving cells.
2. Learn roles of phosphorylated nucleotides and other compounds as universal energy carriersin biological reactions.
3. Gain knowledge Classification, nomenclature, regulation of enzymes, coenzymes, enzymatic reaction mechanisms.
4. Acquire understanding enzymatic reaction energetics in terms of mathematical relationshipsalong with various inhibition mechanisms.

Course content

Section-A

Introduction to metabolism, catabolism, anabolism, Laws of Thermodyanamics and living system, Free energy change and direction of metabolism, Endergonic & exergonic reactions, Characteristics of Metabolic pathways, Compartmentation and Interorganmetabolism, Regulation & evolution of metabolic pathways.

Section-B

ATP: Structure, Free energy change, High group transfer potential, energy coupling with ATP (Creatinine phosphokinase, NDP kinase, Adenylate kinase), metabolic roles of ATP; Biological applications of ATP and its role in bioenergetics, Experimental methods for studying metabolism, Energy rich metabolites, biological oxidation – Reduction reactions

Section-C

Introduction to Enzymes: Nomenclature, Classification and Characteristics of enzymes, Cofactors, Co-enzyme and Prosthetic group, Zymogen, Mechanism of Enzyme Action: Nature of active site, enzyme substrate complex, Factors responsible for catalytic efficiency of enzymes., Covalent catalysis, Acid base catalysis, Strain and distortion theory, Induced fit hypothesis.

Section-D

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

Enzyme inhibition: Reversible and Irreversible inhibition, Regulation of enzyme activityIsozymes (LDH) and their importance.

Course Outcomes:

Sr. No.	On completing the course, the students will b eable to:
CO-1	Learn about types of biochemical reactions involved in the cellular metabolism along with their regulatory mechanisms as well as evolutionary aspects of metabolic pathways
CO-2	Understand the overall bioenergetics involved in coupled metabolic pathways along with involvement of energy rich compounds.
CO-3	Acquire understanding on basic enzymology of cellular metabolism along with catalytic reactions.
CO-4	Learn about kinetics of the enzymatic reactions along with different types of regulation and inhibition mechanisms.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT-BTP121

Biochemistry-II (Bioenergetics and Enzymology) Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

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

Course Objectives

Course contents are designed to enable students to

1. Understand the basics of enzyme catalysed biological reactions.
2. Learn the energetics and other factors affecting the enzymatic activity.
3. Comprehend the metabolically important enzymes catalyzing the hydrolysis ofphosphate esters.
4. Know inside out of the processes of the enzyme inhibition.

Course content

1. Estimation of Alpha-amylase activity from saliva.
2. Assay of acid phosphatase activity.
3. Effect of temperature on enzyme activity.
4. Effect of pH on enzyme activity
5. Determination of Km for acid phosphatase.
6. Determination of pKa value of P-nitrophenol.

Books Recommended

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7th ed, WHFreeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry, 9th Ed.,WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters Kluwer India Pvt.Ltd.
4. J L Jain , Sunjay Jain , Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier

Course Outcomes:

Sr. No.	On completing the course, the students will beable to:
CO-1	Study hydrolysis of glycosidic linkage in polysaccharides.
CO-2	Study pH dependent phosphate esters hydrolysis by the action of phosphomonoesterase enzyme.
CO-3	Study the determination of the temperature as well as pHoptima of enzymatic reactions.
CO-4	Study the significance of substrate concentration in estimating the velocity of the enzyme catalyzed reactions.
CO-5	Demonstrate major types of the enzymeinhibitions

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)
BT-BTL122
General Microbiology-II

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To correlate the knowledge of fundamental Science"s to explore modelling of microbial growth.
2: To make the pupils aware of the viral, fungal, bacterial and general disease.
3: The students made to learn all the techniques of diagnostics of disease casing microbes, prophylactic and preventive microbiology and remedy available for treatment of thesediseases.
4: The theoretical knowledge along with the practical work further strengthened by use and application of ultra-modern instrumentation in world class labs to give first hand practical knowledge of Microbiology.
5: The students will be given knowledge about industrial, medical, environmental microbiology, so that they may become clear about their future job prospects.

Course content

SECTION-A

Factors affecting Microbial Growth: Temperature, pH, provision of gases. Concept of pure and auxenic cultures. Introduction to concept of microbial growth in batch and continuous bioreactor system. Bacterial generation, doubling time and specific Growth rate.Monoauxic, diauxic and synchronised growth curve. Sporulation and regeneration of bacteria.

SECTION-B

Viruses-Introduction, Plant and animal viruses-structure and composition, Classification based on differences in their transcription process. Cultivation of plant and animal viruses by cultuirng in chicken egg only. Life cycle Tobacco Mosaic Virus, Herpes simplex and Bacteriophages (Lysogenic and Lytic cycle)

SECTION-C

Pathogenic microorganisms- Factors contributing towards microbial pathogenicity (Adhesion, Invasiveness and toxigenicity), Natural resistance and Non specific defense mechanism against microorganisms. Introduction, mechanism of action, diagnosis and treatment for viral diseases- COVID - 19, AIDS and Hepatitis.Bacterial diseases- Diphtheria, Tuberculosis, Typhoid.Fungal diseases- Aspergillosis and Candidiasis.

SECTION-D

Introduction to Industrial Microbiology. Microbes involved in Food (Pickles, Saurkraut, Sausage), Single cell protein (Yeast), Antibiotics (Penicillin, Tetracyclin), Organic acids (Citric, Glutamic) and Municipal solid waste transformations.

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4thEdition, Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5thEdition, The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, Londan.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBSPublishers& Distributors.
7. Chander, M. And Puri, P. (2008).A Concise Course in Microbiology.Krishna Brothers Publishers, Old Railway Road, Jalandhar.
8. Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.

Course Outcome

Sr. No.	On completing the course, the students will be able to:
CO-1	Understand the concepts of industrial, medical, environmental microbiology
CO-2	Be aware of etiology of disease can know live a healthy and disease-free life
CO-3	Learn the higher and complex principles of all fields of microbiology.
CO-4	Gain knowledge on the role of microbes infood industry.
CO-5	Become fully acquainted with the microbes as part of our daily life and know about fruits and fines coming from microbes.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT-BTP122

General Microbiology-II Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

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

Course Objectives

1. To correlate the knowledge of the theoratical fields of Microbiology with practical.
2. To make the pupils aware of the role of Microbiology in daily life.
3. The students made to learn all the general features and identification of various microbessuch as fungi, bacteria, virus etc.
4. To teach them microbiology practical applicable in dairy, diagnostics and other industries.
5. The students will be given opportunity to perform each and every experiment, get results andinfer upon their findings.

Couse Content:

1. Enumeration of microorganism. Total vs viable counts.
2. Personal hygiene-Microbes from hands, tooth-scum and other body parts.
3. Growth curve of micro-organisms.
4. Identification of fungus by and lactophenol staining.
5. Identification of formation of germ tube by Candida albicans.

Books Recommended:

1. Cappuccino, J.G. and Sherman, N. (1999). Microbiology: A Laboratory Manual 4th Ed:Harlow, Addition-Wesley.
2. Sambrook, J., Russel, D.W. (2001). Molecular Cloning.A laboratory manual 3rd Ed., ColdSpring Harbor Laboratory Press, New York.
3. Dubey R.C. and Maheshwari (2012) Practical Microbiology 5th edition: S. Chand and company ltd.New Delhi.

Course Outcome

Sr. No.	On completing the course, the students will bea ble to:
CO-1	Become aware of procedures to evaluate various types of microbes and quantify them according to various standards.
CO-2	Have first - hand knowledge on quality control testing and analytical micro biology as is applicableto various industries.
CO-3	Have hands-on training on sterilization techniques, media preparation, and isolation of micro-organisms, bacterial/fungus staining and mounting methods.
CO-4	Apply their knowledge to get suitable job after completion of their degree.

B.Sc (BIOTECHNOLOGY) SEMESTER–II

BT-BTL-123

Genetics

Credit Hours : 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. The objective of this course is to introduce the students with the concepts of chromosomal organisation, extra-chromosomal inheritance and chromosomal aberrations.
2. To inculcate the concepts of Mendel‟s laws of inheritance, crossing over, linkage and how the gene transfer from parents to offspring‟s.
3. To introduce students with the concept of extra Chromosomal (Cytoplasmic) inheritance like inheritance of mitochondrial DNA, chloroplast DNA, kappa articles in Paramecium, Sigma factor in Drosophila, cytoplasmic male sterility (CMS) in maize & its relevancy.
4. To enhance the hand-on experience in dermatographics, to prepare mitotic slides & the practical learning ability.
5. To introduces the students with concept of Basic Microbial Genetics: Conjugation, transduction & transformation and how the gene flows in a horizontal manner.

Course content

Section-A

Organization of Chromosomes: The structure of prokaryotic and eukaryotic chromosome (macromolecular organization and ultrastructure), karyotype, idiogram, centromere and telomere structure, significance of telomerase, euchromatin and heterochromatin, Special chromosomes: Polytene chromosomes and Lampbrush chromosomes, satellite DNA, the supercoiling of DNA.

Section-B

Mendel's Laws of Inheritance: Principle of segregation and Independent assortment, Monohybrid, dihybrid and trihybrid crosses, Back cross and test cross. Interaction of Genes: Incomplete inheritance and co-dominance, pleotropism, modification of F2 ratios: epistasis, complementary genes, supplementary genes, inhibitory genes, duplicate genes, lethality and collaborators genes. Multiple allelism. ABO blood group and Rh factor in human and genetic problems related to it.

Section-C

Linkage: Coupling and repulsion hypothesis, chromosomal theory of linkage, complete and incomplete linkage, linkage groups and significance of linkage. **Crossing Over:** Introduction, mechanism of meiotic crossing over, types of crossing over, factors affecting it and its significance.

Basic Microbial Genetics: Conjugation, transduction, transformation

Section-D

Extra Chromosomal (Cytoplasmic) Inheritance: features; inheritance of mitochondrial DNA, chloroplast DNA, kappa articles in *Paramecium*, Sigma factor in *Drosophila*, cytoplasmic male sterility (CMS) in maize.

Chromosomal aberrations: Structural: deletion, duplication, inversion, translocation; Numerical: polyploidy, aneuploidy; significance of chromosomal aberrations.

Course Outcome

Sr. No.	On completing the course, the students will be able to:
CO-1	Understand the chemical basis of heredity
CO-2	Gain knowledge on genetic methodology and how quantification of heritable traits in families and populations provide insight on the cellular and molecular mechanisms.
CO-3	Gain ability to evaluate conclusions that are based ongenetic data.
CO-4	Understand the role of genetic technologies in industries related to biotechnology, pharmaceuticals,energy, and other fields.
CO-5	Learn teamwork and leadership skills including group analysis of data, working together in the research laboratory, joint compositions of written reports, substantive participation in research group meetings etc.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

BT-BTP123

Genetics Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

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

Course Objectives

1. To make students to solve numerical problem related to mendelism, paternity disputes & multiple alllelism.
2. An understanding of the inheritance and expression of human blood groups.
3. An understanding of the clinical relevance of genetic concepts.
4. Ability to the hand-on experience in dermatographics, to prepare mitotic slides & thepractical learning ability.
5. Knowledge of Internet genetics resources.
6. An historical perspective of how genetics has evolved

Course content

1. Demonstration of Law of segregation and Independent assortment (use of coloured beads,capsules etc.).
2. Numerical problems on Mendelism and on modified F2 ratios.
3. Numerical problems on Paternity disputes (Blood groups)
4. Segregation demonstration in preserved material
5. Study of polytene chromosomes from permanent slides.
6. Dermatographics : Palm print taking and finger tip patterns.
7. Preparation and study of mitosis slides from onion root tips by squash method.

Course Outcome

Sr. No.	On completing the course, the students will be able to:
CO-1	Study the structural and numerical chromosomal aberrations and their consequences.
CO-2	Solve numerical problem related to mendelism, paternity disputes & multiple allelism.
CO-3	Know about various syndromes in humans.
CO-4	Understand the sex linkedinherited characters and diseases.
CO-5	Get in depth knowledge about gene interaction, penetrance and expressivity
CO-6	Demonstrate proficiency in understanding the basic structure of atom and interpret the inheritance of characters by using linkage and crossing over.

Minor Stream Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

ZO-BTL124
Zoology-I

L T
Credit Hours : 2+1=3
Maximum Marks:75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the sections A, B, C and D of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives: The course aims to

1. Understand the metabolic activities in the body of animals.
2. Understand the various bio molecules present in the body.
3. Understand the structure and physiology of endocrine system.
4. Understand the structure and function of blood and heart.
5. Understand the process of digestion and the structure and function of associatedglands.
6. Understand the structure and function of brain.
7. Understand the gaseous transport and the structure involved in gaseous transport.

Course content

Section–A

Introduction to Animal Kindom and its diversification:
Overview and General classification of Kingdom Animalia, General Characteristics of eachgroup upto class level with an example.

Section–B

Digestive System: The alimentary canal and associated glands of Man. Digestion of dietary constituents, regulation of digestive processes and absorption. Extra and intra cellular digestion, enzymatic digestion and symbiotic digestion.
Respiratory System: Respiratory system of man, Transport of O2 and CO2, Oxygen dissociation curve of haemoglobin, Bohr effect, chloride shift, Haldane effect and control of breathing.

Section–C

Circulatory System: General plan of circulation in Man, structure of human heart. Origin and regulation of heart beat, Electrocardiogram, Cardiac output and Blood pressure, Composition and functions of blood and lymph, Blood clotting, blood groups including Rh-factor.
Excretory system: Structure of Kidney and nephron. Urine formation and osmoregulation.

Section–D

Skeletal system: Ultrastructure, chemical and physical basis of skeletal muscle contraction. **Neural Integration**: Structure and functions of brain, Structure of neuron, resting membranepotential, Origin and propagation of impulse along the axon, synapse and myoneural junction. **Endocrine System**: Structure and physiology of thyroid, parathyroid, adrenal, hypothalamus,pituitary, pancreas and gonads of man.

Course Outcomes

Sr. No.	On completing the course, the students will be able to:
CO-1	Develop understanding on various fundamental concepts related to physiology of digestion & absorption
CO-2	Develop understanding on circulatory system and blood components
CO-3	Get familiar with the topics related to nervousand muscular system and their working
CO-4	Learn various aspects of respiratorysystem and exchange of respiratory gases
CO-5	Develop an understanding of endocrine glands,their functioning and associated disorders

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

ZO-BTP124

Zoology-I Lab

Credit Hours : 1
Maximum Marks: 25
Practical: 19
Internal Assessment: 6

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

Course Objectives: The course aims to

1. Study the digestive, circulatory and urinogenital systems of human.
2. Study various macromolecules present in food stuffs.
3. Demonstrate various blood tests in Man.
4. Demonstrate the temporary preparation of blood smear of mammals.

Course content

1. Study the following system of Human with the help of charts / models /videos: Digestive, Arterial, Venous and Urinogenital systems.
2. Analysis of food stuff for the presence of starch, protein and fats.
3. Determination of blood groups of human blood samples.
4. Recording of blood pressure of man.
5. Estimation of hemoglobin content.
6. Make a temporary preparation of the following:Blood smear of mammals.
7. Visit to clinical laboratory / hospital for demonstration of ECG, ECHO, X-ray, ultrasound,CT-scan and MRI.

As per UGC guidelines and instructions, the use of live materials is to be avoided and be replaced with models, simulated dissections and slides.

Books Reccommended

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

Course Outcomes

Sr. No.	On completing the course, the students will be able to:
CO-1	Develop skill for the observation of blood cells.
CO-2	Attain knowledge on qualitative analysis of Macro molecules.
CO-3	Understand the structure and function of various systems of human.
CO-4	Get basic understanding about the experimental methods and designs that can be used for further study and research.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)

MA-BTL125

Biomathematics and Biostatistics

L T
Credit Hours : 2+1=3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory covering whole syllabus and will consist of 8 short-answer type questions, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV respectively of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper. Each question of Section B, C, D and E should be subdivided into atmost two subparts.

Course objectives

1. To enable the students to solve Statistical problems using various measure of central tendency.
2. To help the students to collect the data and present it diagrammatically.
3. To establish linear association between two variables by using Correlation.
4. The content of this course is designed to make the students understand various sampling techniques.
5. To enable the students to apply the various techniques of testing of hypothesis.

Course content

Unit- I

Scientific notation, Significant digits, Rounding off, Scientific notations, Sampling, Problem identification, Concept of population and samples, Random sampling, Data collection, Log, Indices, Design of experiments, differentiation and integration.

Unit- II

Measurement of central tendency, mean, geometric mean, harmonic mean, Median, Mode, Quartile mean, decile, percentile, Dispersion, Mean deviation, Standard deviation, Geometrical standard deviation, Standard error, Coefficient of variation , Variation, Variance, Coefficient of determinant, moments, skewness and kurtosis.

Unit- III

Graphical representation of data, scattered diagram, Straight line, Least square test, Correlation coefficient, Regression coefficient, Correction of experimental data and model development.

Unit- IV

Testing of hypothesis, null and alternate hypothesis, type-I, TYPE II errors, level ofsignificance, Normal distribution, Poisson distribution, Binomial distribution, Student „t"-test, „F"-test, chi-square test, Wilcoxon test, analysis of variance (one way anova)

Books Recommended

1. Kothari, C.R. (2004) Research Methodology Methods and Techniques, New Age International Publications, New Delhi
2. Arora, P.N. &Malhan, P.K. : Biostatistics (Himalaya Publication House)

3. Robert R. Sokal and F. James Rohlf Introduction to Biostatistics

Course Outcomes

Sr. No.	On completing the course, the students will be able to:
CO-1	Learn to solve Statistical problems using various measures of central tendency.
CO-2	Learn how to collect the data and present it diagrammatically.
CO-3	Learn to establish linear association between two variables by using correlation technique.
CO-4	Understand various sampling techniques.
CO-5	Apply various techniques of testing of hypothesis.

Ability Enhancement Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-II)
BCSE-1222 COMMUNICATION SKILLS IN ENGLISH

L	T	P	Credits
3	0	1	4

Time: 3 Hours **Max. Marks: 100**
Theory: 60
Practical: 15
Internal Assessment: 25

Suggested Pattern of Question Paper:
The question paper will be divided into two sections. Section A will consist of Twelve(12) questions of One(1) mark each. Section B will consist of Six questions of Eight(8) marks each. There will be internal choice wherever possible.

Section A

1. Do as directed
Tenses and Change of voice (12X1=12Marks)

Section B

1. **Listening Skills**: Barriers to listening; effective listening skills; feedback skills.
2. **Speaking and Conversational Skills:** Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics.
3. Drafting of a short speech on a given topic.
4. Transcoding (given dialogue to prose or given prose to dialogue).
5. Taking notes on a speech/lecture/telephonic conversations .
6. Translation from Vernacular (Punjabi/ Hindi) to English (Paragraph) (6X8=48 Marks)

Course Objectives:

I: To develop competence in oral and visual communication.
II: To inculcate innovative and critical thinking among the students.
III: To enable them to grasp the application of communication theories.
IV: To acquire knowledge of the latest technology related to communication skills.
V: To provide knowledge of multifarious opportunities in the field of this programme.

Course Contents:

1. **Listening Skills:** Barriers to listening; effective listening skills; feedback skills, attending telephone calls; note taking.
Activities:

a) Listening exercises – Listening to conversation, speech/ lecture and taking notes.

2. **Speaking and Conversational Skills**: Components of a meaningful and easy conversation; understanding the cue and making appropriate responses; forms of polite speech; asking and providing information on general topics, situation based Conversation in English; essentials of Spoken English
Activities:

a) Conversation; dialogue and speech
b) Oral description or explanation of a common object, situation or concept.
c) Interviews and group discussion

Recommended Books:

1. *Oxford Guide to Effective Writing and Speaking* by John Seely.
2. *The Written Word* by Vandana R Singh, Oxford University Press
3. *Murphy's English Grammar* (by Raymond Murphy) CUP

Course Outcomes:

The completion of this course enables students to:

1. Identify common errors in language and rectify them.
2. Develop and expand Oral skills through controlled and guided activities.
3. Develop coherence, cohesion and competence in oral discourse through intelligible pronunciation.
4. Develop the ability to handle the interview process confidently and learn the subtle nuances of an effective group discourse.
5. Communicate contextually in specific and professional situations with courtesy.

PRACTICAL (Marks: 15)

Course Contents:-

1. Oral Presentation. (5 Marks)
2. Group Discussion. (5 Marks)
3. Mock Interview (5 Marks)

B. Sc. Hons. (Physics, Chemistry, Maths), B. Sc. Bio Tech./ IT/ Fashion Designing/ Food Sc., B. A. JMC, BCA, B.Sc. in Computational Statistics and Data Analytics, B.Sc. Artificial Intelligence and Data Science, Bachelor of Vocational (B.Voc.) (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology, Renewable Energy Techology)

Semester-II

Compulsory Course

ਲਾਜ਼ਮੀ ਪੰਜਾਬੀ

Credit & Marks Distribution, Eligibility and Pre-Requisites of the Course

Course title & Code	Total Teaching Hours	Total Credits/ Hours per week	Credit distribution			Total Marks 100		Time Allowed in Exam
			L	T	P	Theory	IA	
ਲਾਜ਼ਮੀ ਪੰਜਾਬੀ **BHPB-1201**	60	4	4	0	0	75	25	3 Hours

ਕੋਰਸ ਦਾ ਉਦੇਸ਼ Course Objective	**ਪਾਠ-ਕ੍ਰਮ ਨਤੀਜੇ Course Outcomes (COs)**
▪ ਵਿਦਿਆਰਥੀਆਂ ਵਿਚ ਸਾਹਿਤਕ ਰੁਚੀਆਂ ਪੈਦਾ ਕਰਨਾ। ▪ ਆਲੋਚਨਾਤਮਕ ਰੁਚੀਆਂ ਨੂੰ ਵਿਕਸਤ ਕਰਨਾ। ▪ ਵਿਦਿਆਰਥੀ ਨੂੰ ਦਫ਼ਤਰੀ ਅਤੇ ਘਰੇਲੂ ਚਿੱਠੀ ਪੱਤਰ ਤੋਂ ਜਾਣੂ ਕਰਵਾਉਣਾ। ▪ ਭਾਸ਼ਾਈ ਗਿਆਨ ਵਿਚ ਵਾਧਾ ਕਰਨਾ।	▪ ਉਸ ਅੰਦਰ ਸਾਹਿਤਕ ਰੁਚੀਆਂ ਪ੍ਰਫੁਲਿੱਤ ਹੋਣਗੀਆਂ। ▪ ਉਸ ਅੰਦਰ ਸਾਹਿਤ ਸਿਰਜਣਾ ਦੀ ਸੰਭਾਵਨਾ ਵਧੇਗੀ। ▪ ਵਿਦਿਆਰਥੀ ਚਿੱਠੀ-ਪੱਤਰ ਦੀ ਲਿਖਣ ਸ਼ੈਲੀ ਤੋਂ ਜਾਣੂ ਹੋਵੇਗਾ। ▪ ਉਹ ਭਾਸ਼ਾਈ ਬਣਤਰ ਤੋਂ ਜਾਣੂ ਹੋਵੇਗਾ।

ਅੰਕ-ਵੰਡ ਅਤੇ ਪ੍ਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

ਸਿਲੇਬਸ ਦੇ ਚਾਰ ਭਾਗ ਹਨ ਪਰ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੇ ਪੰਜ ਭਾਗ ਹੋਣਗੇ। ਪਹਿਲੇ ਭਾਗ ਵਿਚ 1.5-1.5 (ਡੇਢ-ਡੇਢ) ਅੰਕ ਦੇ ਅਤਿ-ਸੰਖੇਪ (Objective Type) 10 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜੋ ਕਿ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਹੋਣਗੇ ਅਤੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹੋਣਗੇ। ਸਿਲੇਬਸ ਦੇ ਬਾਕੀ ਚਾਰ ਭਾਗਾਂ ਵਿਚ 02-02 ਲੇਖ ਨੁਮਾ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਹਰੇਕ ਭਾਗ ਵਿਚੋਂ 01-01 ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਲਾਜ਼ਮੀ ਹੋਵੇਗਾ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 15 ਅੰਕ ਹੋਣਗੇ। ਪੇਪਰ ਸੈੱਟਰ ਜੇਕਰ ਚਾਹੇ ਤਾਂ ਪ੍ਰਸ਼ਨਾਂ ਦੀ ਵੰਡ ਅੱਗੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਚਾਰ ਉਪ-ਪ੍ਰਸ਼ਨਾਂ ਵਿਚ ਕਰ ਸਕਦਾ ਹੈ।

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ 25 ਅੰਕਾਂ ਦੀ ਹੈ। ਇਸ ਪੇਪਰ ਦੇ ਕੁੱਲ ਅੰਕ 75+25=100 ਹਨ।

ਪਾਠ-ਕ੍ਰਮ

ਭਾਗ-ਪਹਿਲਾ

ਸਾਹਿਤ ਦੇ ਰੰਗ, ਡਾ. ਮਹਿਲ ਸਿੰਘ (ਸੰਪਾ.), ਰਵੀ ਸਾਹਿਤ ਪ੍ਰਕਾਸ਼ਨ, ਅੰਮ੍ਰਿਤਸਰ।
ਭਾਗ ਦੂਜਾ - ਵਾਰਤਕ ਅਤੇ ਰੇਖਾ-ਚਿੱਤਰ, ਡਾ. ਪਰਮਿੰਦਰ ਸਿੰਘ, ਡਾ. ਭੁਪਿੰਦਰ ਸਿੰਘ ਅਤੇ ਡਾ.ਕੁਲਦੀਪ ਸਿੰਘ ਢਿੱਲੋਂ (ਸਹਿ ਸੰਪਾ.)
(ਵਾਰਤਕ ਭਾਗ ਵਿਚੋਂ ਸਾਰ/ਵਿਸ਼ਾ-ਵਸਤੂ। ਰੇਖਾ-ਚਿੱਤਰ ਭਾਗ ਵਿਚੋਂ ਸਾਰ/ਨਾਇਕ ਬਿੰਬ)

ਭਾਗ-ਦੂਜਾ

ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ (ਸੰਪਾ. ਬਲਵੰਤ ਗਾਰਗੀ)
ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ।
(ਸਤੀਸ਼ ਗੁਜਰਾਲ ਤੋਂ ਸੁਰਿੰਦਰ ਕੌਰ ਤਕ)
(ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ/ਨਾਇਕ ਬਿੰਬ)

ਭਾਗ-ਤੀਜਾ

(ੳ) ਦਫ਼ਤਰੀ ਚਿੱਠੀ ਪੱਤਰ
(ਅ) ਮੁਹਾਵਰੇ ਅਤੇ ਅਖਾਣ

ਭਾਗ-ਚੌਥਾ

(ੳ) ਸ਼ਬਦ-ਬਣਤਰ ਅਤੇ ਸ਼ਬਦ-ਰਚਨਾ - ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਮੁਢਲੇ ਸੰਕਲਪ
(ਅ) ਸ਼ਬਦ-ਸ਼੍ਰੇਣੀਆਂ

B. Sc. Hons. (Physics, Chemistry, Maths), B. Sc. Bio Tech./ IT/ Fashion Designing/ Food Sc., B. A. JMC, BCA, B.Sc. in Computational Statistics and Data Analytics, B.Sc. Artificial Intelligence and Data Science, Bachelor of Vocational (B.Voc.) (Software Development, Theatre and Stage Craft, Food Processing, Textile Design & Apparel Technology, Renewable Energy Techology)

Semester-II

Compulsory Course

ਮੁਢਲੀ ਪੰਜਾਬੀ

(In Lieu of Compulsory Punjabi)

Credit & Marks Distribution, Eligibility and Pre-Requisites of the Course

Course title & Code	Total Teaching Hours	Total Credits/ Hours per week	Credit distribution			Total Marks 100		Time Allowed in Exam
			L	T	P	Theory	IA	
ਮੁਢਲੀ ਪੰਜਾਬੀ **BPBI-1202**	60	4	4	0	0	75	25	3 Hours

ਕੋਰਸ ਦਾ ਉਦੇਸ਼ Course Objective	**ਪਾਠ-ਕ੍ਰਮ ਨਤੀਜੇ Course Outcomes (COs)**
• ਵਿਦਿਆਰਥੀ ਅੰਦਰ ਸ਼ਬਦ ਬਣਤਰ ਦੀ ਸਮਝ ਵਿਕਸਤ ਕਰਨਾ। • ਵਿਦਿਆਰਥੀ ਨੂੰ ਸ਼ਬਦ ਪ੍ਰਕਾਰ ਬਾਰੇ ਜਾਣਕਾਰੀ ਪ੍ਰਦਾਨ ਕਰਨਾ। • ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦੇ ਵਿਆਕਰਨਕ ਪ੍ਰਬੰਧ ਸੰਬੰਧੀ ਗਿਆਨ ਕਰਾਉਣਾ। • ਸਿਖਲਾਈ ਤੇ ਅਭਿਆਸ ਦੁਆਰਾ ਪੰਜਾਬੀ ਸ਼ਬਦ ਭੰਡਾਰ ਵਧਾਉਣਾ।	• ਉਹ ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ ਦੀ ਜਾਣਕਾਰੀ ਹਾਸਲ ਕਰਕੇ ਭਾਸ਼ਾਈ ਗਿਆਨ ਨੂੰ ਵਿਕਸਿਤ ਕਰਨਗੇ। • ਪੰਜਾਬੀ ਸ਼ਬਦ-ਰਚਨਾ ਸੰਬੰਧੀ ਮੁਹਾਰਤ ਹਾਸਲ ਕਰਨਗੇ। • ਵਿਦਿਆਰਥੀ ਸ਼ਬਦਾਂ ਦੀਆਂ ਭਿੰਨ-ਭਿੰਨ ਕਿਸਮਾਂ ਤੋਂ ਜਾਣੂ ਹੋਵੇਗਾ। • ਵਿਦਿਆਰਥੀਆਂ 'ਚ ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ ਭੰਡਾਰ 'ਚ ਵਾਧਾ ਹੋਵੇਗਾ।

ਅੰਕ-ਵੰਡ ਅਤੇ ਪ੍ਰੀਖਿਅਕ ਲਈ ਹਦਾਇਤਾਂ

ਸਿਲੇਬਸ ਦੇ ਚਾਰ ਭਾਗ ਹਨ ਪਰ ਪ੍ਰਸ਼ਨ-ਪੱਤਰ ਦੇ ਪੰਜ ਭਾਗ ਹੋਣਗੇ। ਪਹਿਲੇ ਭਾਗ ਵਿਚ 01-01 ਅੰਕ ਦੇ ਅਤਿ-ਸੰਖੇਪ ਉੱਤਰ ਵਾਲੇ (Objective Type) 11 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜੋ ਕਿ ਸਾਰੇ ਸਿਲੇਬਸ ਵਿਚੋਂ ਹੋਣਗੇ ਅਤੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹੋਣਗੇ। ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਦੂਸਰੇ ਭਾਗ ਵਿਚ, ਸਿਲੇਬਸ ਦੇ ਪਹਿਲੇ ਭਾਗ ਵਿਚੋਂ ਤਿੰਨ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਕੋਈ ਦੋ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 8-8 ਅੰਕ ਹੋਣਗੇ। ਇਸੇ ਤਰ੍ਹਾਂ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਦੇ ਤੀਸਰੇ ਭਾਗ ਵਿਚ ਤਿੰਨ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 8-8 ਅੰਕ ਹੋਣਗੇ। ਭਾਗ ਚੌਥੇ ਵਿਚ ਪੰਜ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਚਾਰ ਪ੍ਰਸ਼ਨ ਹੱਲ ਕਰਨੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 4-4 ਅੰਕ ਹੋਣਗੇ। ਭਾਗ ਪੰਜਵੇਂ ਵਿਚ ਤਿੰਨ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਜਿੰਨ੍ਹਾਂ ਵਿਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਕਰਨੇ ਲਾਜ਼ਮੀ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ ਬਰਾਬਰ 8-8 ਅੰਕ ਹੋਣਗੇ।

ਨੋਟ: ਇੰਟਰਨਲ ਅਸੈੱਸਮੈਂਟ 25 ਅੰਕਾਂ ਦੀ ਹੈ। ਇਸ ਪੇਪਰ ਦੇ ਕੁੱਲ ਅੰਕ 75+25=100 ਹਨ।

ਪਾਠ-ਕ੍ਰਮ

ਭਾਗ-ਪਹਿਲਾ

ਪੰਜਾਬੀ ਸ਼ਬਦ-ਬਣਤਰ:

ਧਾਤੂ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਮਧੇਤਰ, ਪਿਛੇਤਰ), ਪੰਜਾਬੀ ਕੋਸ਼ਗਤ ਸ਼ਬਦ ਅਤੇ ਵਿਆਕਰਨਕ ਸ਼ਬਦ

ਭਾਗ-ਦੂਜਾ

ਪੰਜਾਬੀ ਸ਼ਬਦ-ਪ੍ਰਕਾਰ:

(ੳ) ਸੰਯੁਕਤ ਸ਼ਬਦ, ਸਮਾਸੀ ਸ਼ਬਦ, ਦੋਜਾਤੀ ਸ਼ਬਦ, ਦੋਹਰੇ/ਦੁਹਰੁਕਤੀ ਸ਼ਬਦ ਅਤੇ ਮਿਸ਼ਰਤ ਸ਼ਬਦ

(ਅ) ਸਿਖਲਾਈ ਤੇ ਅਭਿਆਸ

ਭਾਗ-ਤੀਜਾ

ਪੰਜਾਬੀ ਸ਼ਬਦ-ਰਚਨਾ:

ਇਕ-ਵਚਨ/ਬਹੁ-ਵਚਨ, ਲਿੰਗ-ਪੁਲਿੰਗ, ਬਹੁਅਰਥਕ ਸ਼ਬਦ, ਸਮਾਨਅਰਥਕ ਸ਼ਬਦ, ਬਹੁਤੇ ਸ਼ਬਦਾਂ ਲਈ ਇਕ ਸ਼ਬਦ, ਸ਼ਬਦ ਜੁੱਟ, ਵਿਰੋਧਅਰਥਕ ਸ਼ਬਦ, ਸਮਨਾਮੀ ਸ਼ਬਦ

ਭਾਗ–ਚੌਥਾ

ਨਿੱਤ ਵਰਤੋਂ ਦੀ ਪੰਜਾਬੀ ਸ਼ਬਦਾਵਲੀ

ਖਾਣ–ਪੀਣ, ਸਾਕਾਦਾਰੀ, ਰੁੱਤਾਂ, ਮਹੀਨਿਆਂ, ਗਿਣਤੀ, ਮੌਸਮ, ਬਜ਼ਾਰ, ਵਪਾਰ, ਧੰਦਿਆਂ ਨਾਲ ਸੰਬੰਧਿਤ

SEMESTER–II
PUNJAB HISTORY & CULTURE (C 321 BC TO 1000 A.D.)

(Special Paper in lieu of Punjabi compulsory)
(For those students who are not domicile of Punjab)
Course Code: BPHC-1204

Credit: 04
L- T- P
04-0-0

Time: 3 Hours

Total Marks: 100
Theory: 75
Internal Assessment: 25

Instructions for the Paper Setters:

Question paper should consist of two sections—Section A and Section B. The paper setter must ensure that questions in Section–A do not cover more than one point, and questions in Section–B should cover at least 50 per cent of the theme.

Section–A: The examiner will set 15 objective type questions out of which the candidate shall attempt any 10 questions, each carrying 1½ marks. The total weightage of this section will be 15 marks. Answer to each question should be in approximately one to two sentences.

Section–B: The examiner will set 8 questions, two from each Unit. The candidate will attempt 4 questions selecting one from each Unit in about 1000 words. Each question will carry 15 marks. The total weightage of this section will be 60 marks.

Note: **The examiner is to set the question paper in two languages: English & Hindi.**

Course Objectives: The main objective of this course is to educate the students who are not domicile of the Punjab about the history and culture of the Ancient Punjab. It is to provide them knowledge about the social, economic, religious, cultural and political life of the peopleof the Punjab during the rule of various dynasties such as The Mauryans, The Khushans, The Guptas, The Vardhanas and other ancient ruling dynasties of the period under study.

Unit-I

1. The Punjab under Chandragupta Maurya and Ashoka.
2. The Kushans and their Contribution to the Punjab.

Unit-II

3. The Punjab under the Gupta Emperors.
4. The Punjab under the Vardhana Emperors

Unit-III

5. Political Developments 7th Century to 1000 A.D.

6. Socio-cultural History of Punjab from 7th Century to 1000 A.D.

Unit-IV

7. Development of languages and Literature.

8. Development of art & Architecture.

Suggested Readings:-

L. Joshi (ed.*), History and Culture of the Punjab*, Part-I, Patiala, 1989 (3rdedition).

L.M. Joshi and Fauja Singh (ed), *History of Punjab*, Vol.I, Patiala 1977.

Budha Parkash, *Glimpses of Ancient Punjab*, Patiala, 1983.

B.N. Sharma*, Life in Northern India*, Delhi. 1966.

Course Outcomes:

On completing the course, the students will be able to:

CO-1 Understand the history and culture of the Punjab in Ancient Period.
CO-2 Analyse social, economic, religious, cultural and political life of Ancient Indian dynasties.
CO-3 Study about the political developments from 7th century to 1000 AD.
CO-4 Understand socio-cultural history of the Punjab from 7th century to 1000 AD.
CO-5 Analyse language, literature, art and architecture of Ancient Punjab.

Value Added Courses

B.Sc. (BIO-TECHNOLOGY) SEMESTER–II

Course Code: ZDA121

Course Title-DRUG ABUSE: PROBLEM, MANAGEMENT AND PREVENTIONDRUG ABUSE: MANAGEMENT AND PREVENTION

(Compulsory for all Under Graduate Classes)

Credit hrs/wk.: 2

Time: 3 Hours Max. Marks: 50

Instructions for the Paper Setters:

1) There will be a total of 9 questions of which 5 are to be attempted.
2) Question 1 is compulsory and having 10 short answer type questions (1 mark each).
3) The remaining 8 questions (10 marks each) shall include 2 questions from each unit. Candidates shall be required to attempt 4 questions, one from each unit. Preferably, the question should not be split into more than two sub-parts.

Course Objectives:

The course aim is to

CO-1.	Describe the role of family in the prevention of drug abuse.
CO-2.	Describe the role of school and teachers in the prevention of drug abuse.
CO-3.	Emphasize the role of media and educational and awareness program.
CO-4.	Provide knowhow about various legislation and Acts against drug abuse.

UNIT-I

- **Prevention of Drug abuse**

  Role of family: Parent child relationship, Family support, Supervision, Shaping values, Active Scrutiny.

UNIT-II

- School: Counseling, Teacher as role-model.
- Parent-teacher-Health Professional Coordination, Random testing on students.

UNIT-III

- **Controlling Drug Abuse**

  Media: Restraint on advertisements of drugs, advertisements on bad effects of drugs, Publicity and media, Campaigns against drug abuse, Educational and awareness program

UNIT-IV

- Legislation: NDPS act, Statutory warnings, Policing of Borders, Checking Supply/Smuggling of Drugs, Strict enforcement of laws, Time bound trials.

References:

1. Extent, Pattern and Trend of Drug Use in India, Ministry of Social Justice and Empowerment, Government of India, 2004.
2. Gandotra, R. and Randhawa, J.K. 2018. voZrI d[otos'A (BPky'oh) gqpzXB ns o'eEkw. Kasturi Lal & Sons, Educational Publishers, Amritsar- Jalandhar.
3. Inciardi, J.A. 1981. The Drug Crime Connection. Beverly Hills: Sage Publications.
4. Modi, Ishwar and Modi, Shalini (1997) Drugs: Addiction and Prevention, Jaipur: Rawat Publication.
5. Randhawa, J.K. and Randhawa, Samreet 2018. Drug Abuse-Management and Prevention. Kasturi Lal & Sons, Educational Publishers, Amritsar- Jalandhar.
6. Sain, Bhim 1991, Drug Addiction Alcoholism, Smoking obscenity New Delhi: Mittal Publications.
7. Sandhu, Ranvinder Singh, 2009, Drug Addiction in Punjab: A Sociological Study. Amritsar: Guru Nanak Dev University.
8. Singh, C. P. 2000. Alcohol and Dependence among Industrial Workers: Delhi: Shipra.
9. World Drug Report 2011, United Nations office of Drug and Crime.
10. World Drug Report 2010, United Nations office of Drug and Crime

Course Outcomes:

The students will be able to:

CO-1.	Understand the importance of family and its role in drug abuse prevention.
CO-2.	Understand the role of support system especially in schools and inter-relationships between students, parents and teachers.
CO-3.	Understand impact of media on substance abuse prevention.
CO-4.	Understand the role of awareness drives, campaigns etc. in drug abuse management.
CO-5	Learn about the Legislations and Acts governing drug trafficking and Abuse in India.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-III)

Major Core Courses

BT-BTL231
Fundamentals of Biotechnology

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time: 3 Hours
Note for the paper setters/examiners

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. Students will learn Emergence, basics of biotechnology and scope of Biotechnology asa career.
2. Applications of Biotechnology in health care, agriculture, bioremediation andforensics.
3. The students will learn to use the different biotechnological tools to develop new drugsfor the welfare of society.
4. The students will become familiar with entrepreneurship opportunities in Biotechnology and importance of IPRs in Biotechnology.
5. At the end students will learn role of Biotechnology in the Society and future of Biotechnology.

Course content

Unit I
Emergence, scope and basics of biotechnology

Historical perspective, Appraise the interplay of science & technology in the development of biotechnology, Definition, areas and overview of the Fundamentals of Biotechnology, Biotechnology Research in India. Biotechnology Institutions in India (Public and Private Sector), Biotech Success Stories, Biotech Policy Initiatives. careers and employment opportunities in biotechnology

Unit II
Applications of Biotechnology: An Overview

Applying Biotechnology to Modern life styles: Healthcare – Biopharma : Recombinant human insulin; molecular diagnostics : PCR for infectious disease (viral / bacterial), Applications of PCR, blood screening and genetic testing, Gene therapy, genetic counseling); Agriculture & food production (Genetically engineered food, Seed banks, aquaculture); Green biotechnology (Bioremediation, Biofuels, Conservation); Forensics & biodefense.

Unit III
Bio business and IPRs in Biotechnology

Commercialization of Biotechnology: Concerns and Consequences, Biotechnology Industry Practices & Government regulations, Concept and market potential of Bio
business, Requirements and Objectives of Patent, Patentable and non-patentable inventions, process of writing and filing a patent, patenting genes/ gene fragments /SNPs/ proteins / stem cells

Patents related to bacteria, viruses, fungi and medicinal plants. IPR: Introduction, types (Trade secret, Copyright, trademark)

Unit IV

Biotechnology & Society

Ethical Issues & Regulating the use of Biotechnology: Human cloning, GM foods and GMOs, stem cell; The future of Biotechnology.

Books Prescibed:

1. David P Clark & Nanette J. Pazdernik (2017) Biotechnology – Applying the Genetic Revolution, Elsevier Academic Press.
2. Bernard R Glick, Jack J Pasternak and Cheryl L Patten (2010) MolecularBiotechnology: Principles and applications of Recombinant DNA, ASM Press.
3. Singh, B.D. (2018). Biotechnology expanding horizons, Kalyani Publishers, NewDelhi.
4. Singh, I. and Kaur, B (2010) Patent law and Entrepreneurship, 3rd Edition, Kalyani Publishers.

Course Outcome

CO-1. The students will be able to learn about the use of biotechnological applications in healthcare and society welfare.

CO-2. The students will explore new biotechnological tools and their use in improvement of society by discovering new drugs and techniques to increase livelihood.

CO-3. The students will learn the application of bioinformatic tool- BLAST and its applications in determining the structure and function of different biomolecules.

CO-4. The students will be able to examine the recent discoveries related to structure and functioning of biomolecules through use of different bioinformatics tools.

CO-5. The students will be learn about fundamentals of bioinformatics and will use this knowledge to explore recent discoveries in the field of biotechnology.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-BTP231
Fundamentals of Biotechnology Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment:13

Time: 3 Hours

Course Objectives

1. Students will learn about basic laboratory practices to be followed in biotechnology.
2. The students will gain knowledge about the working of different instruments like waterbath, spectrophotometer, centrifuge, UV- transilluminator and Hot air oven.
3. The working of laminar air flow along with the use of BOD instrument will be given tostudents in order to perform experiments in the controlled environment.
4. The students will become aware about the handling and disposal of hazardous reagentssuch as acids, carcinogenic chemicals like acrylamide, ethidium bromide etc.
5. The students will learn about the basic procedure to patent the differentbiotechnological products.

Course content

1. Good laboratory practices followed in biotechnology laboratory.

2. Introduction, use and maintenance of basic equipments in a biotechnology laboratory (Auto-pipettes, weighing balance, pH meter, Water bath, dry bath, Spectrophotometer, centrifuges, light microscope, electrophoretic apparatus, vortex mixer, magnetic stirrer, rocker, laminar hoods, autoclave, sonicator, UV transilluminator, hot air oven, BOD incubator).

3. Handling and disposal of hazardous reagents (acids, carcinogenic chemicals like acrylamide, ethidium bromide) and concept of chemical hoods.

4. Different steps for patent with the help of example.

Course Outcomes

CO-1. The students will gain information about the different steps in order to clean and maintain the biotechnological laboratory.
CO-2. The students will be able to get hand on training about the working of different instruments and by this they will gain knowledge to conduct biochemical testing of bio-molecules.
CO-3. The information about the procedure to dispose the harmful and toxic biomedical waste will be helpful for students in order to avoid the spread of infectious diseases.
CO-4. The information regarding the protocol to patent the biotechnological products will boost students to develop useful products and safeguard them from illegal practices.
CO-5. This course will be very useful in laying the foundation for biotechnology students to explore different areas of biotechnology in useful manner.

B.Sc. (BIO-TECHNOLOGY) (SEMESTER-III)

BT-BTL232

Immunology-I

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time : 3 Hours

Note for the paper setters/examiners:
The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To comprehend the basic principles of immunology, types of immunity and the molecular mechanisms of innate and adaptive immunity
2. Understanding lymphoid cells, as well as the immune system's primary and secondaryorgans
3. To provide an adequate knowledge of antigen, immunoglobulins and antibody diversity,and the complement system
4. Detailed description of antigen presentation, MHC molecules, humoral and cell-mediated responses

Course content

Unit I

Cells of the immune system: haematopoiesis and differentiation (erhthrocytes, leucocytes and platelets). Types of immunity-innate and adaptive; Features of immune response-memory; Specificityand recognition of self and non-self; Terminology used in the study of immune system.

Unit II

Lymphoid cells, heterogeneity of lymphoid cells; T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic.

Unit III

Antigen, Epitope (B cell & T Cell epitioe), Immunogen, Factors influencing immunogenicity, Immunoglobulins, classes and structure; affinity and avidity; Complement fixing antibodies and complement cascade.

Unit IV

MHC class I and class II molecules, structure T & B Cells and function of class I and class II MHC molecules, structure of T-cell antigen receptors.

Books Recommended:

1. Roitt, I.M. Brostoff, J. and Male, D.K. (2012), Immunology, 8th Edition, Elsevier , NewYork
2. Judy Owen, Jenni Punt, Sharon Stranford, Patricia Jone. (2018), Immunology, 7thEdition. W.H. Freeman and Company, New York
3. Abul K. Abbas, Andrew H. H. Lichtman, Shiv Pillai (2011) Cellular and Molecular Immunology; 7th Edition, Saunders
4. Doan (2012) Lippincott's Illustrated Reviews Immunology ; 2nd Edition, Wolters KluwerIndia Pvt

Course Outcomes

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

CO-1. Understand and demonstrate basic knowledge of immunological processes at the cellular and molecular levels.

CO-2. Distinguish between innate and adaptive immunity, humoral and cell mediated responses.

CO-3. Explain the cell types and organs involved in the immune response.

CO-4. Acquire knowledge about the antigens, different types of Immunoglobulins, and the complement system

CO-5. Describe the immune system's roles in identification, presentation and Processing of the antigens.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-BTP232
Immunology-I Lab

Credit Hours : 2
Maximum Marks: 50
Practical: 37
Internal Assessment:13

Time: 3 Hours

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

Course Objectives

1. To acquire the ability of using laboratory techniques aimed to define the proportion of the different leukocyte populations in a healthy individual.
2. To learn the techniques used in the separation of plasma from blood.
3. Gaining knowledge about the different methods of blood collection.
4. Understanding different agglutination reactions such as hemagglutination.

Course content

1. Differential leucocytes count
2. Total Leucocytes count
3. Total RBC count
4. Separation of Plasma from blood
5. Collection of blood sample by different method.
6. Haemagglutination assay
7. Haemagglutination inhibition assay

Books Recommended

1. Stevans, C.D. (1996). Clinical Immunology and Serology : A Laboratory Perspective F.A.Davis Company, Philadelphia
2. Celis, K.E. (1998). Cell Biology: A laboratory handbook. Vol-I Academic Press, U.K. 3.Hay, F.C. Westwood O.M.R. (2002). Practical Immunology, 4th Ed., Blackwell Science,U.K.

Course Outcomes

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

CO-1. Learn about the diagnostic methods like TLC, DLC.
CO-2. Differentiate between different types of white blood cells.
CO-3. Understand the difference between blood plasma and serum and also about their role in clinical field.
CO-4. Perform different immunological techniques such as hemagglutination, etc.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-BTL233
Biochemistry-III (Metabolism of Carbohydrates and Lipids)

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time: 3 Hours

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

- Students will acquire knowledge about the various metabolic pathways in human body.
- Students will learn in detail about carbohydrate metabolism and its regulatory pathways.
- Students will learn in detail about Lipid metabolism and its regulatory pathways.

Unit-I

Carbohydrate metabolism: - Biosynthesis and degradation of carbohydrates, Glycolysis, gluconeogenesis, feeders pathways for glycolysis, Glycogenesis, Glycogenolysis, regulation of carbohydrates metabolism.

Unit-II

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

Unit-III

Lipid Catabolism: Oxidation of fatty acids, degradation of triacylglycerol, phosphoglycerides, sphingolipids, regulation of lipid metabolism.

Unit-IV

Lipid Anabolism: Synthesis of fatty acids, triacylglycerol, phosphoglycerides , sphingolipids, cholesterol.

Books Recommended

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7thed, WH Freeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry,9th Ed., WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters KluwerIndia Pvt. Ltd.
4. J L Jain , Sunjay Jain , Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, SChand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier

Course Outcome

At the end of the course

CO-1. Students will have learnt about the carbohydrates and lipids anabolic and catabolic processes.

CO-2. Students will have learnt about the carbohydrate and lipid metabolism regulatory processes and pathways at molecular level

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-BTP233 Biochemistry-III (Metabolism of Carbohydrates and lipids) Lab

Time: 3 Hours

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

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

Course Objectives

1. To give students hands on experience in preparation of reagents, buffers and media preparation.
2. To make students understand the concept of reducing sugars and determine it in givesample.
3. Students will perform paper chromatography of plant pigments & spectral analysis ofvarious plant pigments, and perform thin layer chromatography.
4. Students will learn and perform the extraction of lipids from wheat grains

Course content

1. Determination of reducing sugar using 3,5 dinitrosalicylic acid.
2. Spectral analysis of various plant pigments
3. Separation of lipids from wheat grains.
4. Separation of macromolecules using thin layer chromatography
5. To perform Hb1Ac
6. Oral glucose tolerance test

Course Outcome

At the end of this course

CO-1. Students will have learnt about the basic concept of molarity, normality & prepare reagents and buffers.
CO-2. Students will be aware of the clinical significance of oral glucose tolerance test and HbA1c
CO-3. Students will be able to handle microscopes, spectrophotometer and other lab equipments.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-BTL234 Molecular Biology

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time: 3 Hours

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. The course will provide a brief overview of Nucleic acid background comprising of salient features and models of DNA and RNA

2. The course will mainly focus on the study of principal molecular events of cellincorporating DNA Replication, Transcription and Translation in prokaryotic as wellas eukaryotic organisms.
3. The course will also emphasize Post Transcriptional Modifications and Processing of Eukaryotic RNA covering the concepts of Split genes, Introns, Exons, Splicing Mechanisms and RNA Editing.

4. The course will also impart detailed explanation of Prokaryotic and Eukaryotic Transcriptional Regulation along with mechanism of Gene Silencing.

5. To enhance the significance & Practical applications of Mutation .

Course Content

Unit I

Molecular basis of life. Nucleic acid as the genetic (Griffith materialexperiment, Avery Mcleod and Harshey chase experiment, Meselson and stahl experiment), Structure of DNA & RNA.A, B, Z, form of DNA, DNA replication in both prokaryotes and eukaryotes.

Unit II

RNA synthesis and processing RNA synthesis and processing (transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, genetic code, Principles of gene regulation, negative and positive regulation, concept of operon (Lac operon).

Unit III

Protein synthesis and processing Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic codeaminoacylation of tRNA, aminoacyl tRNA synthetase and translational proof-reading, translational inhibitors, Post- translational modification of proteins.

Unit IV

DNA recombination molecular mechanisms : prokaryotic and eukaryotic. Mutation: Spontaneous versus induced mutations, types of mutations, mutations rate and frequency, Mutagens: Physical and Chemical, the molecular basis of mutations. Significance & Practical applications of Mutation Insertion elements and transposons with appropriate examples.

Books Recommended

1. George M Malacinski (2015) Freifelders Essentials Of Molecular Biology, 4Th/Ed,Jones & Bartlett
2. David P. Clark, Nanette J. Pazdernik, Michelle R. McGehee (2018), 3rd edition,Molecular Biology, Academic Cell
3. Pk Gupta(2018) MOLECULAR BIOLOGY , 2nd Edition, Rastogi Publications
4. James D. Watson, A. Baker Tania, P. Bell Stephen , Gann Alexander, Levine Michael,Losick Richard (2017)Molecular Biology of the Gene, 7th Ed, Pearson Education

Course Outcome

CO-1. This gives them a strong foundation on the basics structure and functions of nucleic along with replication of genetic material in prokaryotes and eukaryotes.

CO-2. Molecular Events of Transcription and processing of transcripts, RNA editing.

CO-3. Molecular Events of Translation leading to protein synthesis and Post translational modification.

CO-4. Students will get insight into the process of recombination and mutations.

CO-5. Understand and apply the principles and techniques of molecular biology which prepares students for further education, basic and applied research, and/or as health professionals.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

BT-BTP234 Molecular Biology Lab

Time: 3 Hours **Credit Hours: 2**

Maximum Marks: 50

Practical: 37

Internal Assessment: 13

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

Course Objectives

- Cognize basic concepts and terminology of the main techniques of molecular biology.
- To prepare various Preparation of stock solutions
- To perform the extraction of nucleic acids (DNA) in order to cover different levels of a research in molecular biology and genetics.
- To perform Gel casting and Setting up of gel apparatus 4. Preparation of Agarose gelfor agarose gel electrophoresis.
- To quantify DNA by spectrophotometric and fluorometric (Ethidium bormide)analysis.
- To collect and correlate the information obtained and knowing how to present in the form of a scientific report.

Course content

1. Preparation of stock solutions.
2. Isolation of genomic DNA from plants.
3. Gel casting and Setting up of gel apparatus
4. Preparation of Agarose gel for agarose gel electrophoresis
5. Spectrophotometric determination of purity.
6. Quantification of DNA by spectrophotometric and fluorometric (Ethidium bormide)analysis.

Books Recommended:

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

Course Outcome

CO-1. This gives them and terminology of the main techniques of molecular biology.
CO-2. To understand the Isolation of genomic DNA from plants and Gel casting and Setting up of gel apparatus.
CO-3. To learn about the preparation of Agarose gel for agarose gel electrophoresis.
CO-4. To gain thorough knowledge about Quantification of DNA by spectrophotometric and fluorometric (Ethidium bormide) analysis.

Minor Courses

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

CH-BTL235
Chemistry-II (Organic)

L T

Credit Hours : 2+1=3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time: 3 Hours

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course objectives

1. Students will learn about aromatic compounds, alkanes, alkenes.
2. Stereochemistry (3D arrangement of molecules), the reactivity of carbonyl compounds with both hard and soft nucleophiles (carboxylic acids, aldehydes and ketones.

Course content

Unit I

Reactive intermediates

Carbocations, carbanions, free radicals, carbenes, arenes and nitrenes (with examples). Assigning formal charges on intermediates and other ionic species

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

Unit II

Aromaticity

Aromatic electrophilic substitution–general pattern of the mechanism, role of σ and π complexes. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel Crafts reaction. Energy profile diagrams. Activating and deactivating substituents, orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Methods of formation and chemical reactions of alkylbenzenes

Unit III

Stereochemistry: Molecular chirality, enantiomers/symmetry in achiaral structures, chiral centres in chiral molecules, properties of chiral molecules-optical activity, absolute and relative configuration, the Cahn-Ingold Prelog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantionmers, chiral centres other than carbon, prochirality.

Unit IV

Functional group transformation by nucleophilic substitution, the biomolecular (SN^2), mechanism of nucleophilic substitution , stereochemistry of SN^2 reactions, how SN^2 reactions occur, steric effect in SN2reactions, nucleophiles and nucleophilicity, the unimolecular (SN^1) mechanism of nucleophilies substitution, carbocation stability and the rate of substitution, by the SN^1 mechanism sterochemistry of SN1reactions, carbocation real arrangements in SN^1 reactions, solvent effects, subtitution and elimination as competing reactions.

Books Recommended

1. R.T. Morison and R.N. Boyd, Organic chemistry
2. I. L. Finar, Organic Chemistry, Vol.I, IV ed. J. March, Advanced Organic Chemistry, Reactions Mechanisms and Structure.
3. Schaum‟s Outlines Series, Theory and Problems of Organic chemistry.
4. I.L. Finar, Problems and their solution in Organic chemistry.
5. J. D. Robert and M. C. Caserio, Modern Organic Chemistry.
6. D. J. Cram and G. S. Hammond, Organic chemistry.
7. J. E. Banks, Naming Organic Compounds - Programmed Introduction to OrganicChemistry
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F. A. Carey, Organic chemistry

Course outcomes:

S. No.	On completing the course, Students will be having
CO1	Basic knowledge on the nomenclature, structure, stability and method of preparation ofvarious reaction intermediates.
CO2	Knowledge of various field effects line Inductive, Electromeric, Resonance and Hyperconjugation along with some interactive forces.
CO3	Practice on the electrophilic substitution on the aromatic systems and information on thedirective influence of various groups on these reactions.
CO4	Knowledge on some aspects of stereochemistry,Chirality, Prochirality, R-S and relatedtopics.
CO5	Detailed knowledge of the Nucleophilic Substitution reactions SN1 and SN2 and the factorseffecting these reactions.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)

CH-BTP235

Chemistry-II (Organic) Lab

Time: 3 Hours

Credit Hours: 1
Maximum Marks: 25
Practical: 19
Internal Assessment: 6

Course objectives

Students will gain practical knowledge of handling chemicals.
Students will learn identification of functional groups: Aldehydes, ketones, acids, Phenols, Amines and carbohydrates

Course content

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

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

1. Amides
2. Amines
3. Carboxylic acids and phenols.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

4. Aromatic hydrocarbons
5. Aldehydes
6. Ketones
7. Carbohydrates

Course outcomes

S. No.	**On completing the course,**
CO1	To perform various functional group tests in identification of organic compounds Such as phenols, carboxylic acids, carbonyl compounds, carbohydrates etc.
CO2	Systematic qualitative analysis of organic compounds for the detection of elements
CO3	Identification of the compounds and preparation of derivative and determination of its melting point.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)
Programme Code: BSBT
Course Code: BO-BTL236
Course Title: Botany-II

L T

Credit Hours : 2+1=3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives:

CO-1	To study the physiological processes in plants.
CO-2	To study the mode of transmission & control measures of plant diseases and host-pathogen interactions.
CO-3	To study the concept of biodiversity, population growth, population growth curves and biogeographical zones of India.

Unit I

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

Unit II

Photosynthesis: Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO_2 fixation-C3, C4 and CAM pathways.

Unit III

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

Unit IV

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

Books Recommended:

1. Sharma, P.D. *Plant Pathology*. India: Rastogi Publication, 2011. Print.
2. Sharma, P.D. *Ecology and Environment*. 8th ed. India: Rastogi Publications, 2010. Print.
3. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A. *Plant Physiology and Development*. 6th ed. USA: Sinauer Associates Inc., 2015. Print.
4. Hopkins, W.G. and Huner, A. *Introduction to Plant Physiology*. 4th ed. USA: John Wiley and Sons, 2008. Print.
5. Shibu, J., Singh, H.P., Batish, D.R. and Kohli, R.K. *Invasive Plant Ecology*.New York, USA: CRC Press, Taylor and Francis Group, Boca Raton, 2013. Print.

Course Outcomes:

CO-1	To understand the role of water and water related processes in plants.
CO-2	To deeply learn the process of plant adaptation under stressed environment (cold, heat, drought and salt).
CO-3	To gain knowledge about role of stress induced proteins and osmolytes in plants under the influence of abiotic stressors.
CO-4	To learn the concept of plant pathology, occurrence of plant diseases and their transmission.
CO-5	To understand the disease cycle of the pathogens causing diseases in plants, the symptoms it causes and the epidemiology of the disease.
CO-6	To learn the importance of biodiversity and population growth and its characteristics.

B.Sc. BIOTECHNOLOGY (SEMESTER–III)
Programme Code: BSBT
Course Code: BO-BTP236
Course Title: Botany-II Lab

Credit Hours: 1
Maximum Marks: 25
Practical: 19
Internal Assessment: 6

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

CO-1	To study the basic plant physiological processes.
CO-2	To study the relative moisture contents in plants (leaf), osmotic potential.
CO-3	To study the process of transpiration in plants by mercury method.
CO-4	To study the evolved oxygen during the process of photosynthesis in plants.
CO-5	To study the different types of pigments present in plants and their separation *via* TLC method.
CO-6	To study the basics of plant pathology which includes plant pathogens and their symptoms appears on plants.

Practicals

1. Estimation of relative water content of leaf.
2. Measurement of osmotic potential of different tissues by Chardokov method.
3. Demonstrate the transpiration pull by mercury method.
4. Demonstration that $0_2$is evolved during photosynthesis.
5. Separation of pigments by paper chromatography/TLC method
6. Study of Plant pathogens (a) Symptoms of the diseases (b) Morbid anatomy of the plants infected with following diseases. Black stem rust of wheat, Loose smut of wheat, Late and early blight of potato, Red rot of sugarcane, TMV of potato, Yellow vein mosaic of bhindi.

Course Outcomes:

CO-1	Students will learn about the percentage of moisture content present in plants (leaf)
CO-2	To know about the concept of osmotic potential and their measurement by prescribed method
CO-3	To know about the transpiration process, evolution of oxygen though laboratory techniques
CO-4	Students will know about the nature and importance of plant pigments
CO-5	They will learn about the plant pathology, causal organisms and know about the symptoms appears on infected plants.

Ability Enhancement Courses

Course code: ESL–221
Course Title: ENVIRONMENTAL STUDIES–I (COMPULSORY)

Credit Hours (Per Week): 2
Maximum Marks : 50Marks

Instructions for Paper Setters: The question paper will consist of three sections. Candidate will be required to attempt all the sections. Each unit of the syllabus should be given equal weightage ofp marks. Paper to be set in English, Punjabi and Hindi

Section–A: (16 Marks): It will consist of five short answer type questions. Candidates will be required to attempt four questions, each question carrying four marks. Answer to any of the questions should not exceed two pages.

Section–B: (24 Marks): It will consist of five questions. Candidates will be required to attempt four questions, each question carrying six marks. Answer to any of the questions should not exceed four pages.

Section–C: (10 Marks): It will consist of two questions. Candidate will be required to attempt one question (carrying ten marks) only. Answer to the question should not exceed 5 pages.

Course Objectives:

CO-1	The main goal of Environmental studies is to create the environmental awareness to create a safe, green and sustainable environment.
CO-2	To make students aware about the importance of ecosystem, types of ecosystem, energy flow in an ecosystem, ecological succession, food chain and food web.
CO-3	To make students aware of water conservation, global warming, consumerism and waste products and also about the environmental protection acts.
CO-4	Role of National Service Scheme (NSS). Health and hygiene.

Unit-I

The Multidisciplinary Nature of Environmental Studies: Definition, components, scope and importance of environment/environmental studies, Need for public awareness.

Natural Resources: Definition, types, use, over exploitation, benefits, case studies (if any) and associated problems of following natural resources: Forest Resources, Water Resources, Mineral Resources, Food Resources, Energy Resources, Land Recourses *etc.*

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

Unit-II

Ecosystem: General introduction, types (Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems *viz.* ponds, streams, lakes, rivers, oceans, estuaries), Structure and functions of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Unit-III

Social Issues and Environment: Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting. Resettlement and rehabilitation of people: its problems and concerns. Case studies, Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and its cause. Case studies.Wasteland reclamation.

Environmental Protection Act: Air (prevention and Control of Pollution) Act.Water (prevention and Control of Pollution) Act. Wildlife Protection Act, Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness

Unit-IV

National Service Scheme

Introduction and Basic Concepts of NSS: History, philosophy, aims & objectives of NSS; Emblem, flag, motto, song, badge *etc.;* Organizational structure, roles and responsibilities of various NSS functionaries.

Health, Hygiene & Sanitation: Definition, needs and scope of health education; Food and Nutrition; Safe drinking water, water borne diseases and sanitation (Swachh Bharat Abhiyan); National Health Programme; Reproductive health.

Suggested Books:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2013 . Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Basu, M., Xavier, S. 2016. Fundamentals of Environmental Studies, Cambridge University Press, India
3. Down to Earth, Centre for Science and Environment, New Delhi.
4. Jadhav, H. and Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
5. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pvt. Ltd., Delhi.
6. Kaushik, A. and Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
7. Mahapatra, R., Jeevan, S.S. and Das, S. 2017. Environment Reader for Universities, Centre for Science and Environment, New Delhi.
8. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
9. Raven, P.H., Hassenzahl, D.M. and Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
10. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
11. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar
12. Kanta, S., 2012. Essentials of Environmental Studies, ABS Publications, Jalandhar.
13. Saroj A., Kaur R., Walia H., Kaur T, 2021. Environmental Studies - A Holistic Approach, KLS Publishers.

Suggested Websites:

A. https://nss.gov.in
B. https://moef.gov.in
C. http://punenvis.nic.in
D. https://www.unep.org

Course Outcomes:

CO-1	To learn about the sustainable environment.
CO-2	To gain the knowledge ecosystem and its functioning.
CO-3	To know about the water conservation programs like rain water harvesting and water shedding and to gain knowledge of environmental (air, water and pollution) protections acts.
CO-4	To know about the role and importance of NSS– a volunteer organization, in making up a better environment and to maintain better health and hygiene.

B.Sc. (BIO-TECHNOLOGY)
(SEMESTER-IV)
Major Core Courses

B.Sc. (BIO-TECHNOLOGY) (SEMESTER–IV)

BT-BTL241 Industrial Biotechnology-I

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time: 3 Hours

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To comprehend the basic principles of Industrial biotechnology.
2. To describe the principles of fermentation process.
3. Understanding the different methods of microbial isolation, identification and preservation.
4. To learn about the methods used for strain improvement of industrially important microbes.
5. Theoretical knowledge about the production of dairy products, primary and secondary metabolites, and the role of enzymes in industries.

Course Contents

Unit I

History of general and industrial Microbiology, Basic concept of Industrial fermentation and its significance in industry. Differences between microbial industrial processes and chemical industrial processes. Production of modern biotechnology products- recombinant proteins having therapeutic and diagnostic applications (insulin and growth hormones)

Unit II

General study and characterization of industrial important microbes. Methods of isolation, screening, selection and Identification of industrial microbes. Maintenance and preservation of industrially important microbial cultures.

Unit III

Strain improvement of industrial important microbes: by using mutational programme and recombination systems (par sexual cycle, protoplast fusion and recombinant DNA techniques), Isolation of mutants (induced, auxotrophic, resistant and revert ant mutants), Inoculums Development, media formulation and process optimization of Industrial and agro industrial microbes.

Unit IV

Introduction to primary and secondary metabolites production. Dairy products like curd, yoghurt, Cheese, bread, proteases in leather processing industries.

Books Recommended:

1. Davis, B.D., Dulbecco. R., Eisen, H.N. and Ginsberg, H.S. (1990). Microbiology: 4thEdition, Harper & Row, Publishers, Singapore.
2. Tortora, G.J., Funke, B.R. and Case, C.L. (1994). Microbiology: An introduction: 5thEdition, The Benjamin / Cummings Publishing Company, Inc.
3. Stanier, R.Y. (1995). General microbiology, MacMillan Press, Londan.
4. Pelczar, M.T. (1995). Microbiology, Tata McGraw Hill Publication, New Delhi.
5. Schlegel. H. G., (1995). General Microbiology 7th Edition, Cambridge Univ. Press.
6. Prescott and Dunn (1999). Industrial Microbiology 4th Edition, By S.K. Jain for CBSPublishers & Distributors.
7. Purohit, S.S. (2000). Microbiology: Fundamentals and Applications (6th Edition),Agrobios (India).
8. Postgate. J. (2000). Microbes & Man 4th Edition, Cambridge Univ. Press.
9. Tortora. G.J., Funke. B.R., 2001. Microbiology: An Introduction, Benjamin Cummings.
10. Stanbury, P.F., Whitaker, A. and Hall, S.J. (2001), Principles of FermentationTechnology 2nd ed., Pergamon Press, Oxford.
11. Frazier, W.C. and Westhoff, D.C. (2003) Food Microbiology. 18th Edition, TataMcGraw Hill, Inc., New York.
12. Industrial Biotechnology: Approach to Clean Technology · Jogdand, S.N. HimalayaPublishing House 2006. ISBN: ISBN number: 9788183184250.

Course Outcome

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

CO-1. Apply biotechnology to industrial processes. Students will also gain knowledge about the basic fermentation process.

CO-2. Identify the suitable methods of isolation, identification and preservation of microbes. Students will also get to know about the inoculum development and media formulation process.

CO-3. Understand how bacteria and other microbes can be manipulated by recombinant DNA technology or selective isolation for use in industrial processes to generate products of interest.

CO-4. Learn the basic steps involved in production of curd, yoghurt, cheese, bread, primary and secondary metabolites. Students will also get familiarized with the role of proteases in leather processing industries.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTP241 Industrial Biotechnology-I Lab

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

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

Course Objectives

a) To learn about the basic methods of microbial isolation.

b) Measurement of bacterial cell size.

c) Identification of an organism in the coliform group.

d) To know the importance of starter culture in fermentation process.

e) To perform nitrate reduction test.

Course content

a) Isolation of microbial cells by serial dilution-spread plate method, pour plate.
b) Measurement of bacterial size.
c) Metabolic Characterization by IMVIC test
d) Alcoholic and Mixed–Acid Fermentation.
e) Starter culture preparation, evaluation and application.
f) 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 introduction to practical biochemistry (Tata McGraw HillPublishers Co. Ltd., New Delhi).
3. Bansal, D.D., K Hardori, R., Gupta, M.M. (1985). Practical biochemistry (StandardPublication Chandigarh).
4. Dubey R.C. and Maheshwari (2012) Practical Microbiology 5th edition: S. Chand and company ltd. New Delhi.

Course Outcome

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

CO-1. Perform the serial dilution, spread plate and pour plate method of bacterial isolation.

CO-2. Measure the dimensions of microorganisms under microscope by a technique known as micrometry.

CO-3. Differentiate between coliforms, i.e., bacteria of the genera Escherichia and Enterobacter, into species and varieties.

CO-4. Prepare starter cultures for the fermentation processes.

CO-5. Determine whether the microorganism can reduce nitrate or not.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTL242 Immunology-II

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Time: 3 Hours

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. Theoretical knowledge about the production of monoclonal antibodies and also, the role of various types of T-cells.
2. To learn about the basic techniques for identifying antigen-antibody interactions.
3. Elucidation of various mechanisms that regulate immune responses against the pathogensand maintain tolerance
4. To provide an adequate knowledge about different types of vaccines.

Course content

Unit I

T-cell subsets and surface markers, T-dependent and T-independent antigens, recognition of antigens by T-cells. Monoclonal antibodies: its production and uses.

Unit II

Various types of immunodiffusion and immunoelectrophoretic procedures. ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and haemagglutination inhibition. Flow cytometry and fluorescence.

Unit III

Immunity to viruses, intracellular and extracellular bacteria, immunopathological consequences of parastitic infections, immune invasion, mechanism used by parasites, regulation of immune invasion, mechanism used by parasites.

Unit IV

Active and passive immunization, Adjuvants, whole organism vaccine, purified macromolecules as vaccine, recombinant antigen vaccine, recombinant vector vaccine, synthetic peptide vaccine, multivalent subunit vaccine, DNA Vaccine

Books Recommended:

a) Roitt, I.M. Brostoff, J. and Male, D.K. (2012), Immunology, 8th Edition, Elsevier ,New York
b) Judy Owen, Jenni Punt, Sharon Stranford, Patricia Jone. (2018), Immunology, 7thEdition. W.H. Freeman and Company, New York
c) Abul K. Abbas, Andrew H. H. Lichtman, Shiv Pillai (2011) Cellular and Molecular Immunology; 7th Edition, Saunders
d) Doan (2012) Lippincott's Illustrated Reviews Immunology ; 2nd Edition, WoltersKluwer India Pvt
e) Goldsby, R.A., Kindt, T.J., Osborne, B.A. (2006). Kuby Immunology, 4th ed., W.H.Freeman and Company, New York

Course Outcome

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

CO-1. Learn aboutT-cell subsets and surface markers and Hybridoma Technology

CO-2. Identify antigen-antibody interactions using techniques such as precipitation, immune-electrophoresis, agglutination, ELISA, and RIA

CO-3. Investigate the mechanisms underlying the immune response to various infectious agents such as bacteria, viruses, and parasites.

CO-4. Elucidate the reasons for immunisation and be aware of the various vaccinations.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTP242 Immunology-II Lab

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

Time : 3 Hours

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

Course Objectives

1. Understanding the significance of various vaccines used for children.

2. Demonstration ofantigen-antibody interaction by using immunodiffusion techniques

3. To perform the agglutinations reactions: hemagglutination and hemagglutination inhibitionassay.

4. Comparison of direct and indirect ELISA.

Course content

1. Preparation of vaccine chart of child, highlighting optional vaccines
2. Haemagglutination assay
3. Haemagglutination inhibition assay
4. Double immunodiffusion test using specific antibody and antigen Line of identity, partial identity and non-identity
5. Single immunodiffusion test using specific antibody and antigen
6. Direct and indirect ELISA

Books Recommended

1. Stevans, C.D. (1996). Clinical Immunology and Serology : A Laboratory Perspective
    1. F.A. Davis Company, Philadelphia
2. Celis, K.E. (1998). Cell Biology : A laboratory handbook. Vol-I Academic Press, U.K.
3. Hay, F.C. Westwood O.M.R. (2002). Practical Immunology, 4th Ed., BlackwellScience, U.K.

Course Outcome

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

CO-1. Understand the importance of vaccination.

CO-2. Performsingle and double immunodiffusion technique for the detection, identification and quantification of antibodies and antigens.

CO-3. Determinewhether a patient has ever had any infection, for e.g., *Salmonella typhi* infection by using agglutination reactions.

CO-4. Apply immunological techniques such as direct and indirect ELISA as a diagnostic tool.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTL243 Biochemistry-IV (Metabolism of Proteins and Nucleic acid)

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. To understand the basic concept of Proteins and Nucleic acid biosynthesis.
2. To acquire the knowledge of advanced pathways leading to the biosynthesis ofbuilding blocks of proteins and nucleic acids.
3. To learn how energy is obtained through the catabolism of proteins and nucleic acids.
4. To make students aware of the metabolic defects in these pathways leading to severe disorders.

Course content

Unit I

Amino Acid Metabolism: Transamination reactions of amino acids, urea cycle, catabolism of essential amino acids, Inborn errors of Metabolism and amino acid degradation.

Unit II

Amino Acid Metabolism: Biosynthesis of essential amino acids, Regulation of amino acid biosynthesis by feed back inhibtion

Unit III

Nucleic Acid Metabolism: Biosynthesis of purines and pyrimidines nucleotides, regulation of nucleotide biosynthesis.

Unit IV

Nucleic Acid Metabolism: Degradation of purines and pyrimidines , nucleotides, salvage pathway. Disorders of nucleotide metabolism: Lesch Nyhan syndrome, Gout, SCID, Adenosine deaminase deficiency.

Books Recommended:

1. David L. Nelson and Michael Cox (2017) Lehninger Principles of Biochemistry, 7th ed,WH Freeman
2. Jeremy M. Berg, Lubert Stryer, John Tymoczko , Gregory Gatto (2019) Biochemistry,9th Ed., WH Freeman
3. Ferrier (2017) Lippincott's Illustrated Reviews Biochemistry, 7th Ed, Wolters KluwerIndia Pvt. Ltd.
4. J L Jain , Sunjay Jain , Nitin Jain (2016) Fundamentals of Biochemistry, 7th Ed, S Chand
5. Satyanarayana (2020) Biochemistry, 5th Ed, Elsevier

Course Outcome

CO-1. Students will study complete catabolism of essential Amino Acids and Nucleotides.

CO-2. Students will be acquainted with the knowledge Biosynthesis of essential Amino Acids and Nucleotides.

CO-3. The course will help the students to understand the abnormalities in the metabolism of Amino Acids and Nucleotides and their relationship to various diseases.

CO-4. Biological processes are keenly regulated; in this course students will also acquire the information about regulation of these pathways.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTP243 Biochemistry-IV lab (Metabolism of Proteins and Nucleic Acid)

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

Time: 3 Hours

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

Course Objectives

1. To apply the biochemical principals in the estimation of basic biomolecules like amino acids and cholesterol.
2. To learn the process of fat estimation from milk.
3. Students learn the precipitation of proteins using isoelectric point and salt precipitation methods as it‟s the first step in studying any protein.

Course content

1. Isolation of Casein from milk
2. Determination of fat content in milk.
3. Estimation of cholesterol in a given sample.
4. Purification of protein using salt precipitation.
5. Quantitative estimation of amino acids using the ninhydrin reaction.

Course Outcome

CO-1. Good experimental and quantitative skills encompassing preparation of laboratory reagents, conducting experiments, satisfactory analyses of data and interpretation of results.
CO-2. Awareness of resources, and their conservation.
CO-3. Students will develop a conceptual and practical understanding of protein isolation using protein isoelectric point and Salt precipitation .
CO-4. Estimation of biomolecules lies at the heart of biochemistry, students will learn estimation of Amino Acids ,cholesterol and fat content of a sample.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTL244 Skill Development in Biotechnology

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. The aim of this course is to make students aware about the use of biofertlizers in agricultural processes.
2. Students will learn about the different types of microorganisms that are used in the production of biofertlizers.
3. Students will learn about the different types of processes for nitrogen fixation and various types of medicinal plants and their applications.
4. Students will be able to understand the extraction of essential oils from plants such as Eucalyptus, Levender, Rosa grass and Tulsi.
5. Students will be able to understand different types of clinical and molecular diagnostic tests performed by using blood sample to understand the physiology and biochemistry of blood in humans.

Course content

Unit I: Biofertilizers

Biofertilizers: Introduction and types and importance of biofertilizers, Microorganisms used in biofertilizers production, Biological Nitrogen fixation VIZ: Rhizobium: Process of nodule formation ,Role of Nif and Nod gene in, Enzyme nitrogenase and its component, Different methods of application of biofertilizers, Strategies of Mass production and packing, Registration of biofertilizers.

Unit II: Herbal Biotechnology

Introduction to medicinal plants and their medicinal value, Phytochemicals, Essential oil: definition, extraction and applications in domestic life, industry and other purposes (Eucalyptus, Levender, Rosa grass, Tulsi).
Disease management of medicinal and aromatic plants.

Unit III: Clinical and molecular diagnostics

Collection of blood samples, preparation and use of different anticoagulants, estimation of CBC, TLC, DLC, bleeding count, clotting time, ESR, PCB, principles of X-ray, MRI, ultrasonography, CT scan, ECG, ECHO, Overview of vector borne diseases: Dengue, Chickengunia, PCR based diagnosis of Bacterial, viral & fungal diseases (covid-19, Swine flu, Tuberculosis, Candidiasis)

Unit IV: Bioentrepreneurship

Overview of bioindustries, public/private funding opportunities; Innovation-focused thinking. Preparation of a business plan: socio-economic cost benefit analysis; Statutory and legalaspects. Business and market strategy: pricing, financing, market linkages, branding

Books Recommended

1. Fundamentals of Foods, Nutrition and Diet Therapy, (English, Mudambi Sumati R.), New Age International publication,
2. Clinical Dietetics and Nutrition, by Antia F P (Author), Oxoford publication.
3. Alpers.D.H. , Stenson W.F.and Bier.D.M., (2002). Manual of Nutritional Therapeutics,4th edition, Lippincott Williams & Wilkins, Philadelphia, USA.
4. Research pare and e notes.
5. F. Bakkali, S. Averbeck , D. Averbeck, M. Idaomar. (2008). Biological effects of essential oils – A review. Food and Chemical Toxicology 46: 446–475.
6. R. Amorati,M. C. Foti, L. Valgimigli. (2013). Antioxidant Activity of Essential Oils. Journal of Agriculture and Food Chemistry. 61:10835−10847.
7. A Sharma, D.S. Cannoo. (2016). Comparative evaluation of extraction solvents/techniques for antioxidant potential and phytochemical composition from roots of Nepeta leucophylla and quantification of polyphenolic constituents by RP- HPLC-DAD. Food Measure. doi 10.1007/s11694-016-9349-5
8. Sharma and D. S. Cannoo. (2013). Phytochemical composition of essential oils isolated from different species of genus NEPETAof Labiatae family: a review. Pharmacophore, 4 (6): 181-211.
9. Sarikurkcu, B. Tepe, D. Daferera, M. Polissiou, Mansur Harmandar. (2008). Studies on the antioxidant activity of the essential oil and methanol extract of Marrubium globosum subsp. globosum (lamiaceae) by three different chemical assays. Bioresource Technology, 99: 4239–4246.

Course Outcome

CO-1. The students will be able to learn about the strategies of mass production, packing and registration of biofertlizers.

CO-2. The students will learn different methods to collect blood samples from different body parts of humans in order to perform clinical diagnostic tests.

CO-3. The students will learn to estimate CBC, TLC, DLC, bleeding count, clotting time, ESR, X-ray, MRI, CT scan, ECG, ECHO, ultrasonography and PCB.

CO-4. The students are able to understand the life cycles of various bacterial, viral and fungal diseases like Dengue, Chickengunia, Covid-19, Swine flu, Tuberculosis and Candidiasis.

CO-5. Students will be learn about bioentrepreneurship in order to perform business and learn market strategy of healthcare products.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTP244 Skill Development in Biotechnology Lab

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

Time: 3 Hours

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

Course objectives

1. The aim of this course is to make students aware about the use of biofertlizers in agricultural processes.
2. Students will learn about the different types of microorganisms that are used in the production of biofertlizers.
3. Students will learn about the different types of processes for nitrogen fixation and various types of medicinal plants and their applications.
4. Students will be able to understand the extraction of essential oils from plants such as Eucalyptus, Levender, Rosa grass and Tulsi.
5. Students will be able to understand different types of clinical and molecular diagnostic tests performed by using blood sample to understand the physiology and biochemistry blood in humans.

Course content

1. Isolation of Rhizobium from root nodules
2. Production of commercial biofertilizers using *Rhizobium*.
3. Extraction of essential oils through oil distillation apparatus.
4. To measure total polyphenolic content of the essential oil.
5. Total flavanoid content of the essential oil.
6. Investigating the antioxidant potential of the oils by DPPH assay.
7. Antimicrobial activity of essential oils.
8. Estimation of CBC/DLC/TLC/Bleeding count/Clotting time/ESR/PCB
9. Estimation of BMR
10. Estimation of lipid profile
11. Estimation of blood glucose

Course Outcome

CO-1. The students will be able to learn about the strategies of mass production, packing and registration of biofertlizers.

CO-2. The students will learn different methods to collect blood samples from different body parts of humans in order to perform clinical diagnostic tests.

CO-3. The students will learn to estimate CBC, TLC, DLC, bleeding count, clotting time, ESR, X-ray, MRI, CT scan, ECG, ECHO, ultrasonography and PCB.

CO-4. The students are able to understand the life cycles of various bacterial, viral and fungal diseases like Dengue, Chickengunia, Covid-19, Swine flu, Tuberculosis and Candidiasis.

CO-5. The students will be learn about bioentrepreneurship in order to perform business and learn market strategy of healthcare products.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTL245 Fundamental of Bioinformatics

Credit Hours: 3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

Note for the paper setters/examiners:

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives

1. The aim of this course is to make students learn about Genome sequencing Projects, Various primary and secondary databases.
2. Students will have hands on practice for sequence alignment, Multiple sequence alignment, Multiple sequence alignment alignment, Phyllogenetic tree construction and analysis.
3. Students will learn about the fundamentals of computers and functioning of datastorage devices such as primary and secondary storage devices.
4. Students will be able to understand the scoring matrices like PAM and BLOSUM and their uses in multiple sequence alignment.
5. Students will learn about various online platform of bioinformatics such as NCBI, EBI, DDBJ, Expasy, PUBMED, PDB, UNIPROT, Pfam and Prosite.

Course content

Unit I

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

Unit II

Introduction to bioinformatics: History, Milestones and Applications, Local and Global alignments, Gap Penalities, Pairwise sequence alignments (Needleman-Wunsch, Smith-Watermann Algorithms), Significance of Sequence Alignment.

Unit III

Scoring Matrices: PAM, BLOSUM,
Multiple Sequence Alignment: Progressive Alignment, Iterative Alignment Methods,
Database Searching: BLAST and its types

Unit IV

Primary and Secondary databases, Online resources of Bioinformatics: Introduction about: NCBI, EBI, DDBJ, Expasy, PUBMED, PDB, UNIPROT, Pfam, Prosite.

Books Recommended:

1. Norton‟s P. (2001). Introduction to Computing Fundamental. McGraw Hill Education,New Delhi.
2. Sinha P.K. (2001). Fundamental of Computers. BPB Publication, New Delhi.
3. Jin Xiong.(2006) Essential Bioinformatics. Cambridge University Press.
4. Baxevais B.F. and Quellette F. (2004). Bioinformatics a Practical Guide to the Analysisof Genes and Proteins. Wiley-Interscience

Course Outcome

CO-1. The students will be able to learn about the general introduction to computers and the organization of different parts of computers.

CO-2. The students will about the history, milestones and applications of bioinformatics.

CO-3. The students will learn the application of bioinformatic tool- BLAST and its applications in determining the structure and function of different biomolecules.

CO-4. The students will be able to examine the recent discoveries related to structure and functioning of biomolecules through use of different bioinformatics tools.

CO-5. The students will be learn about fundamentals of bioinformatics and will use this knowledge to explore recent discoveries in the field of biotechnology.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTP245 Fundamental of Bioinformatics Lab

Credit Hours: 2
Maximum Marks: 50
Practical: 37
Internal Assessment: 13

Time : 3 Hours

Note: The question paper will be set by the examiner based on the syllabus. Practical related to theory shall be carried out for this course.

Course Objectives

Students will learn Emergence, basics of biotechnology and scope of Biotechnology as a career.

1. Applications of Biotechnology in health care, agriculture, bioremediation andforensics.
2. The students will learn to use the different biotechnological tools to develop new drugsfor the welfare of society.
3. The students will becomes familiar with entrepreneurship opportunities in Biotechnology and importance of IPRs in Biotechnology.
4. At the end students will learn role of Biotechnology in the Society and future of Biotechnology.

Course content

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

Course Outcome

CO-1. The students will be able to learn about the use of biotechnological
CO-2. The students will about the learn the
CO-3. The students will learn the application of bioinformatic tool- BLAST and its applications in determining the structure and function of different biomolecules.
CO-4. The students will be able to examine the recent discoveries related to structure and functioning of biomolecules through use of different bioinformatics tools.
CO-5. The students will be learn about fundamentals of bioinformatics and will use this knowledge to explore recent discoveries in the field of biotechnology.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

BT-BTP246 Industrial/Institutional Visit

Max. Marks: 50

Educational Tour & Written illustrated reports. Viva should be conducted by a panel of three internal examiners.

Minor Courses

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)
ZO-BTL247 Zoology-II

Time: 3 Hours
Note for the paper setters/examiners:

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Credit Hours : 2+1=3
Maximum Marks: 75
Theory: 56
Internal Assessment: 19

The question paper will consist of five sections: A, B, C, D, and E. Section A is compulsory and will consist of 8 short-answer type questions covering the whole syllabus, with each question carrying 2 marks. Candidates are required to attempt six questions from this Section. Sections B, C, D, and E will have two questions from the Unit I, II, III and IV of the syllabus and carry 11 marks. Candidates are required to attempt one question each from Sections B, C, D, and E of the question paper.

Course Objectives: The paper aims to

1.	Describe the theory of natural selection.
2.	Understand how species evolve.
3.	Describe origin of species on earth.
4.	Understand various pathogenic microbes and diseases caused by them, their occurrence and eradication programmes.
5.	Understand the life history, mode of infection and pathogenicity of pathogenic protozoans and helminthes.
6.	Study the life cycle and control measures of arthropod vectors of human disease.

Course content

Unit I

Origin of Life on Earth: Origin of earth and primitive earth conditions, Theories of origin of life (Theory of Extraterrestrial contact- Import of life through meteorites, Special creation theory, Oparin Haldane Theory, Abiogenesis , Evidences against theory of spontaneous generation of life, Biogenesis, Theory of chemical evolution, Miller & Urey Experiment).
Evolution of Prokaryotes and Eukaryotes (unicellularity to multicellularity).

Unit II

Evolution: Definition, Scope and History, Theories of Evolution (Lamarckism, Darwinism, Hugo de Vries and Modern theory of Evolution).
Geological time scale.

Unit III

Introduction to Parasitology (pertaining to various terminologies in use). Brief account of Life history, mode of infection and pathogenicity of the following pathogens with reference to man, prophylaxis and treatment.

Pathogenic Protozoans: Entamoeba, Trypanosoma, Giardia and Plasmodium.
Pathogenic Helminths: Tape Worm, Ascaris and Ancylostoma.

Unit IV

Arthropod vectors of human diseases: Malaria, Yellow fever, Dengue haemorragic fever, Filariasis, Plague and Epidemic typhus. Distribution and control of the above mentioned vectors.

Books Recommended:

- Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4th ed), ASM Press Washington.
- Panikar, C. K. and Ghosh Sougata. (2018). Textbook of Medical Parasitology (8thEdition), Jaypee Brothers Medical Publishers (Pl Ltd.), New Delhi.
- Harrison A. (2000). Principles of Medicine.
- Loker, Eric S. and Bruce V. Hofkin (2015). Parasitology: A Conceptual Approach,Garland Science, Taylor & Francis Group, New York and London.
- Zimmer, C. 2000. Parasite Rex: Inside the Bizarre World of Nature‟s Most DangerousCreatures, The Free Press, New York.

Course Outcomes

CO-1.	To develop an understanding of concept evolution & different proposed theories of evolution
CO-2.	To develop understanding of origin of life and concept of species and speciation
CO-3.	Study of Pathogenic protozoans, helminthes, their pathogenicity, prophylaxis & treatment.
CO-4.	Have insight into physiology, biochemistry, reproduction and control measures of insect vectors.

B.Sc. BIOTECHNOLOGY (SEMESTER–IV)

ZO-BTP247 Zoology-II lab

Credit Hours: 1
Maximum Marks: 25
Practical: 19
Internal Assessment: 6

Time: 3 Hours

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

Course Objectives: The paper aims to

1.	Understand evolutionary phenomena: homology and analogy.
2.	Understand the skeleton of human.
3.	Study histology of man.
4.	Study permanent slides of parasitic protozoans, helminthes and arthropods.

Course content

1. Study of Evolutionary phenomenon with the help of charts / models /videos: Homology, Analogy and Mimicry.
2. Study of the skeleton of human.
3. Study of the following prepared slides: histology of man (compound tissues).
4. Study of following prepared slides/specimen :

   Pathogenic Protozoans: Entamoeba, Trypanosoma, Giardia and Plasmodium.

   Pathogenic Helminths: Tape Worm, Ascaris and Ancylostoma.

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

Books Recommended

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

Course Outcomes

CO-1.	Students will be able to understand various evolutionary phenomenon.
CO-2.	Students will be able to study the skeleton of man.
CO-3.	Students will be able to study the histology of man through permanent stained slides.
CO-4.	Students will be able to study the protozoans, parasitic helminthes , arthropods vectors of various diseases through permanent slides

Ability Enhancement Courses

SEMESTER–IV
Course Code: ESL–222
Course Title: ENVIRONMENTAL STUDIES–II (COMPULSORY)

Credit Hours (Per Week): 2
Maximum Marks: 50Marks

Instructions for Paper Setters: The question paper will consist of three sections. Candidate will be required to attempt all the sections. Each unit of the syllabus should be given equal weightage of marks. Paper to be set in English, Punjabi and Hindi
Section–A: (16 Marks): It will consist of five short answer type questions. Candidates will be required to attempt four questions, each question carrying four marks. Answer to any of the questions should not exceed two pages.
Section–B: (24 Marks): It will consist of five questions. Candidates will be required to attempt four questions, each question carrying six marks. Answer to any of the questions should not exceed four pages.
Section–C: (10 Marks): It will consist of two questions. Candidate will be required to attempt one question (carrying ten marks) only. Answer to the question should not exceed 5 pages.

Course Objectives:

CO-1	To study the concept of Biodiversity – role, importance, values and its conservation. Hot spots and threats to biodiversity.
CO-2	To create awareness regarding environmental pollution, its causes and effects and preventive measure to control the different types of pollution.
CO-3	To make students aware of growing human population – causes and concern. Family welfare programs. Road safety (Traffic) rules.
CO-4	To know about entrepreneurship development and civil/self defense.

Unit-I

Biodiversity and its Conservation:

1. Definition: Genetic, species and ecosystem diversity.
2. Biogeographical classification of India.
3. Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and optionvalues.
4. Biodiversity of global, National and local levels.
5. India as mega-diversity nation.
6. Hot-spots of biodiversity.
7. Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts. Threatened and endemic species of India.
8. Endangered species, vulnerable species, and rare species.
9. Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity. National Parks, Wild life sanctuaries, Biosphere reserve, Project Tiger, Project Elephant.

Unit-II

Environmental Pollution:

Environmental Pollution: Concepts and Types

1. Definition, causes, effects and control measures of:

a) Air Pollution
b) Water Pollution

c) Soil Pollution
d) Marine Pollution
e) Noise Pollution
f) Thermal Pollution
g) Nuclear Hazards
h) Electronic Waste

2. Concepts of hazards waste & human health risks.
3. Solid Waste Management: Causes, effects and control measures of municipal, biomedical and e-waste
4. Role of an individual in prevention of pollution.
5. Pollution case studies.
6. Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Unit-III

Human Population and the Environment

1. Human population growth: impacts on environment.
2. Population explosion-Family welfare programme.
3. Environment and human health: Concept of health and disease, common communicable and non communicable diseases, public awareness
4. Human rights.
5. Value education.
6. Women and child welfare.
7. Role of information technology in environment and human health.
8. Environment movments in India: Chipko movement, Silent valley movement and other case studies.
9. Road Safety Rules & Regulations**:** Use of Safety Devices while Driving, Do's and Don'tswhile Driving, Role of Citizens or Public Participation, Responsibilities of Public underMotor Vehicle Act, 1988, General Traffic Signs.
10. Accident & First Aid**:** First Aid to Road Accident Victims, Calling Patrolling Police &Ambulance.

Unit-IV

National Service Scheme:

1. **Entrepreneurship Development:** Definition & Meaning; Qualities of good entrepreneur; Steps/ ways in opening an enterprise; Role of financial and support service Institutions.
2. **Civil/Self Defense:** Civil defense services, aims and objectives of civil defense; Needs for self-defense training.

Field Visits:

1. Visit to a local area to document environmental assets–river/forest/grassland/ hill/mountain.
2. Visit to a local polluted site–Urban/Rural/Industrial/Agricultural.
3. Study of common plants, insects, birds.
4. Study of simple ecosystems–pond, river, hill slopes etc.
5. Contribution of the student to NSS/any other social cause for service of society.
6. Visit to Museum/Science City
7. Municipal solid waste management and handling.

Note: In this section the students will be required to visit and write on the environment of an area/ ecosystem/vi1lage industry/disaster/mine/dam/agriculture field/waste management/ hospital etc. with its salient features, limitations, their implications and suggestion for improvement.

References/Books:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Down to Earth, Centre for Science and Environment, New Delhi.
4. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
5. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, PearsonEducation (Singapore) Pte. Ltd., Delhi.
6. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies,New Age International (P) Ltd, New Delhi.
7. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
8. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
9. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex,Amritsar
10. Asthana, D.K. 2006. Text Book of Environmental Studies, S. Chand Publishing.
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Course Outcomes:

CO-1	To know about the meaning of Biodiversity and its role in environment.
CO-2	To know about the causes of different forms of pollution and their control measures.
CO-3	To know about the causes and challenges of growing human population. Women and child welfare programs.
CO-4	To know the development of entrepreneurship and techniques of civil/self defense.