FACULTY OF LIFE SCIENCES

SYLLABUS

Of

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

(Under Continuous Evaluation System)

Session: 2021-22

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

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

PSO1. gain and apply knowledge of Biotechnology and Science concepts to solve problems related to field of Biotechnology.

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

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

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

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

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

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

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2021-22

Bachelor of Science (Bio-Technology) Semester-I							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BBTL -1421 BBTL -1031 BBTL -1431	Punjabi (Compulsory) [1]Basic Punjabi [2]Punjab History and Culture	C	50	40	-	10	3
BBTL-1102	Communication Skills in English	C	50	40	-	10	3
BBTM-1483	Cell Biology	C	60	30	18	12	3+3
BBTM-1074	Botany-I	C	60	30	18	12	3+3
BBTM-1085	Biochemistry-I	C	60	30	18	12	3+3
BBTM-1346	General Microbiology-I	C	60	30	18	12	3+3
BBTM-1087	Chemistry-I	C	60	30	18	12	3+3
AECD-1161	[*]Drug Abuse: Problem Management and Prevention (Compulsory)	AC	50	40	-	10	3
SECF-1492	[*]Foundation Course	AC	25	20	-	5	1
Total			**400**				

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

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

[*]Marks of these papers will not be added in total marks and only grades will be provided.

C-Compulsory
AC- Audit course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2021-22

Bachelor of Science (Bio-Technology) Semester II							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BBTL -2421 BBTL -2031 BBTL -2431	Punjabi (Compulsory) [1]Basic Punjabi [2]Punjab History and Culture	C	50	40	-	10	3
BBTM-2102	Communication Skills in English	C	50	25	15	10	3+3
BBTL-2333	Biostatistics	C	40	32	-	8	3
BBTM-2484	Zoology-I	C	60	30	18	12	3+3
BBTM-2065	Genetics	C	60	30	18	12	3+3
BBTM-2086	Biochemistry-II	C	60	30	18	12	3+3
BBTM-2347	General Microbiology-II	C	60	30	18	12	3+3
AECD-2161	[*]Drug Abuse: Problem Management and Prevention (Compulsory)	AC	50	40	-	10	3
SECM-2492	[*]Moral Education	AC	25	20	-	5	-
Total			**380**				

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

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

[*]Marks of these papers will not be added in total marks and only grades will be provided.

C-Compulsory

AC- Audit course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2021-22

Bachelor of Science (Bio-Technology) Semester-III							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BBTM-3061	Fundamentals of Biotechnology	C	60	30	18	12	3+3
BBTM-3062	Immunology-I	C	60	30	18	12	3+3
BBTM-3083	Chemistry-II	C	60	30	18	12	3+3
BBTM-3074	Botany-II	C	60	30	18	12	3+3
BBTM-3085	Biochemistry-III	C	60	30	18	12	3+3
BBTM-3066	Molecular Biology	C	60	30	18	12	3+3
AECE-3221	*Environmental Studies (Compulsory Paper)	AC	100	60	20	20	3
SECP-3512	*Personality Development	AC	25	20	-	5	-
Total			**360**				

***Marks of these papers will not be added in total marks and only grades will be provided.**

C-Compulsory

AC- Audit Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2021-22

Bachelor of Science (Bio-Technology) Semester-IV							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BBTM-4061	Industrial Biotechnology-I	C	60	30	18	12	3+3
BBTM-4062	Immunology-II	C	60	30	18	12	3+3
BBTM-4083	Biochemistry-IV	C	60	30	18	12	3+3
BBTM-4064	Skill Development in Biotechnology	C	60	30	18	12	3+3
BBTM-4065	Fundamentals of Bioinformatics	C	60	30	18	12	3+3
BBTM-4486	Zoology-II	C	60	30	18	12	3+3
BBTT-4067	Industrial/ Institutional Visit	C	20	-	20	-	-
SECS-4522	*Social Outreach	AC	25	20	-	5	-
Total			**380**				

***Marks of these papers will not be added in total marks and only grades will be provided.**

C-Compulsory

AC- Audit Course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2021-22

Bachelor of Science (Bio-Technology) Semester-V							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BBTL-5061	Patent Laws in Biotechnology	C	40	32		08	3
BBTM-5062	rDNA Technology-A	C	60	30	18	12	3+3
BBTM-5063	Concepts of Plant Tissue Culture	C	60	30	18	12	3+3
BBTM-5064	Animal Tissue Culture	C	60	30	18	12	3+3
BBTM-5065	Bioprocess Engineering-A	C	60	30	18	12	3+3
BBTM-5066	Biophysical and Biochemical Techniques-A	C	60	30	18	12	3+3
BBTM-5087	Physical, Organic and Inorganic Aspects of Spectroscopy-A	C	60	30	18	12	3+3
BBTS-5068	Term Paper	C	20	-	20	-	-
SECJ-5551	*Job Readiness course	AC	25	20	-	5	-
Total			**420**				

***Marks of these papers will not be added in total marks and only grades will be provided.**

C-Compulsory
AC- Audit course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2021-22

Bachelor of Science (Bio-Technology) Semester-VI							
Course Code	**Course Name**	**Course Type**	**Marks**				**Examination Time (in Hours)**
			Total	**Ext.**		**CA**	
				L	**P**		
BBTL-6061	Intellectual Property Rights and Enterpreneurship	C	40	32		08	3
BBTM-6062	rDNA Technology-B	C	60	30	18	12	3+3
BBTM-6063	Applications of Plant Tissue Culture	C	60	30	18	12	3+3
BBTM-6064	Animal Biotechnology	C	60	30	18	12	3+3
BBTM-6065	Bioprocess Engineering-B	C	60	30	18	12	3+3
BBTM-6066	Biophysical and Biochemical Techniques-B	C	60	30	18	12	3+3
BBTM-6087	Physical, Organic and Inorganic Aspects of Spectroscopy-B	C	60	30	18	12	3+3
BBTT-6088	Educational Tour and Written Illustrated Reports	C	20	-	20	-	-
Total			**420**				

C-Compulsory

B.Sc. Bio-Technology Semester-I

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1483
Cell Biology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1. Understanding the basic unit of life – cell and broad classification of cell types.

CO2. Understanding the structure and functions of cell organelles.

CO3: Understand Cell Division and Cell Cycle.

CO4. Understanding the biological membranes along with membrane transport mechanism.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1483
Cell Biology
(Theory)

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

Instructions for the Paper Setter

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

Unit-I

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.

Unit-II

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, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin).

Unit-III

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).

Unit-IV

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

Books Recommended:

1. De-Robertis, F.D.P. and De-Robertis Jr. E.M.F. (2017) Cell and Molecular Biology, Saunders, Philadelphia.
2. Lodish, Berk, Kaiser, Krieger, Scott, Bretscher, Ploegh and Matsudaira (2007) Molecular Cell Biology 6th Edition, W.H.Freemen& Co Ltd.
3. Geoffrey, M. Cooper & Robert E. Hausman (2013) The Cell: A molecular approach 6th Edition, Sinauer Associates.
4. Alberts, Johnson, Lewis, Raff, Roberts and Walter (2008) Molecular Biology of the Cell, 5th Edition, Garland Science.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1483(P)
Cell Biology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1. Perform a variety of molecular and cellular biology techniques.

CO2. Describe cellular membrane structure and function, fine structure and function of cell organelles.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1483 (P)
Cell Biology
(Practical)

Time: 3 Hours **Practical Marks: 18**

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

Experiments:

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1074
Botany-I

Course outcomes:

After passing this course the student will be able to:

CO1: Understand the diversity of plants.

CO2: Understand the structure of root and stem.

CO3: Understand structure and development of anther, male gametophyte, ovule and female gametophyte.

CO4: Understand different aspects of Pollination, fertilization and sterility.

CO5: Understand terminology related to floral descriptions.

Bachelor of Science (Bio-Technology) Semester -I
Session: 2021-22
Course code: BBTM-1074
Botany-I
(Theory)

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

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

Unit –A

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

Unit –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*.

Unit –C

Reproduction in flowering plants: Structure and development of anther and male gametophyte, 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.

Unit –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. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
2. Peau, K. (1977). Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
3. Pegeri, K. And Vander Pijl (1979). The Principles of Pollination Biology, Pergamon Press, Oxford.
4. Dickinson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.

5. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA and UK.
6. Hopkins, W.G. and Huner, P.A. (2008). Introduction to Plant Physiology. John Wiley and Sons.
7. Taiz, L. and Zeiger, E. (2006). Plant Physiology, 4 th edition, Sinauer Associates Inc .MA, USA

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course code: BBTM-1074 (P)
Botany-I
(Practical)

Course outcomes:

After passing this course the student will be able to:

CO1: Understand anatomy of root, stem and leaves.
CO2: Understand structure and development of anther, male gametophyte, ovule and female gametophyte.
CO3: Understand the floral identification and descriptions.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1074 (P)
Botany-I
(Practical)

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

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

Instructions for the paper setter: Question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya MahaVidyalaya, Jalandhar.

Experiments:

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 IV of the theory paper.

Books Recommended:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2000). The Embryology of Angiosperms, 4th revised and enlarged edition. Vikas Publishing House, Delhi.
2. Peau, K. (1977). Anatomy of Seed Plants, 3rd edition. John Wiley & Sons, New York.
3. Pegeri, K. And Vander Pijl (1979). The Principles of Pollination Biology, Pergamon Press, Oxford.
4. Dickinson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.
5. Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA and UK.
6. Hopkins, W.G. and Huner, P.A. (2008). Introduction to Plant Physiology. John Wiley and Sons.
7. Taiz, L. and Zeiger, E. (2006). Plant Physiology, 4 th edition, Sinauer Associates Inc .MA, USA.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1085
Biochemistry-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Gain basic knowledge about water and pH.

CO2: Acquire the knowledge of Carbohydrates, their classification, biological functions that can relate in day to day life

CO3: Understand the definition, structure and Biological function of lipids and their subclasses.

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

CO5: Apply the knowledge of biomolecules in the research of molecular biology

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1085
Biochemistry-I
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

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

Unit-IV

Proteins: Structure of amino acids, non-protein and rare amino acids and their chemical reactions. Structural organization of proteins (Primary, Secondary, Tertiary, Quaternary, A310 and domain structure, protein classification and function. Forces stabilizing Primary, Secondary and Tertiary protein structures

Books Recommended:

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

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

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

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

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1085 (P)
Biochemistry-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform Beer Lamberts Law

CO2: Determine pKa value while performing practical

CO3: Estimate carbohydrates and sugars in the given sample

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1085(P)
Biochemistry-I
(Practical)

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

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

Experiments:

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

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1346
General Microbiology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: know the contribution of microbiologists, the principle and application of various types of microscopic techniques.

CO2: apply the concept, principle and types of sterilization techniques while performing microbiological experiments

CO3: apply the concept and characteristics of antiseptics, disinfectants & their mode of action in day to day life

CO4: Perform microbial preservation methods.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1346
General Microbiology-I
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

Basic concept of Microbial growth & culture media and its components, Sterilization-Basic concept, physical and chemical methods of sterilization. Bacterial Nutrition-Introduction, Nutritional forms of bacteria, Basic concept of Transport mechanisms of nutrients across microbial cell membranes: Facilitated diffusion, Active transport and Group translocation

Unit-III

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

Unit-IV

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: Refrigeration, Cryopreservation, lyophilization, Paraffin method

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1346(P)
General Microbiology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Sterilize glassware & plastic ware while performing microbiological experiments.

CO2: Learn and do basics of microbiological experiments like to make cotton plugs

CO3: cultivate various bacteria, fungi, yeast etc by different methods

CO4: Study motility of microbes.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1346(P)
General Microbiology-I
(Practical)

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

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

Experiments:

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

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1087
Chemistry-I
(Theory)

Course outcomes:

Students will be able to:

CO1: understand the key features of coordination compounds viz.variety of structures, oxidation numbers and electronic configurations, coordination numbers and explain the bonding and stability of complexes along with their nomenclature and structure.

CO2: describe the shapes and structures of coordination complexes with coordination numbers ranging from 1 to 12.

CO3: recognize, name and draw the structures of isomers in coordination compounds.

CO4: explain the valence bond approach for the co-ordinate complex.

CO5: describe the stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters from them.

CO6: understand macrocyclic effect, crown ethers, cryptands.

CO7: understand Crystal field Splitting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of ligands.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1087
Chemistry-I
(Theory)

Time: 3 Hrs. **Max. Marks: 40**
Theory: 30
Practical: 18
CA: 12

Instructions for the Paper Setter

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

Unit-I

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.

Unit-II

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

Unit-lll

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.

Unit-IV

Crystal field theory-Splitting of d-orbitals in octahedral, tetrahedral, cubic and square planer fields of 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.

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

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1087 (P)
Chemistry-I
(Practical)

Course outcomes:

Students will be able to:

CO1: understand the technique of volumetric analysis

CO2: understand Iodimetry, Iodometry

CO3: understand Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$.

CO4: identify the various ions present in the mixture.

Bachelor of Science (Bio-Technology) Semester-I
Session: 2021-22
Course Code: BBTM-1087 (P)
Chemistry-I
(Practical)

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

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

Experiments

Volumetric Analysis:

Iodimetry, Iodometry, Redox titrations using $K_2Cr_2O_7$ and $KMnO_4$.

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:

Dil. H_2SO_4 group: CO^{2-}_3, NO^-_2, S^{2-}, SO_3^{2-}

Conc, H_2SO_4 group: Cl^-, Br^-, I^-, NO_3^-, CH_3COO^-

Individual group: SO_4^{2-}, PO_4^{3-}, BO_3^{3-}

C. Basic radical analysis:

NH_4^+ Pb^{2+}, Cu^{2+}, Cd^{2+}, Fe^{2+} or Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+} Mg^{2+}, Na^+, K^+ and their confirmation.

Book recommended:

G. Svehla, B. Sivasankar, Vogels Qualitative Inorganic Analysis 7 Edition, 2012

B.Sc. Bio-Technology Semester-II

Bachelor of Science (Bio-Technology) Semester–II
Session 2021-22
Biostatistics
Course Code: BBTL-2333

Course Outcomes

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

CO 1: Discuss and explain what Biostatistics is and how it is used in the field of Biology.

CO 2: Calculate summary statistics (mean, median, mode, range, standard deviation and variance) from the data.

CO 3: Apply basic statistical concepts commonly used in health and medical sciences.

CO 4: Familiar with the concepts of probability, conditional probability and Bayes theorem.

CO 5: Familiar with the concepts of correlation and regression.

CO 6: Know what drawing a random sample from a population means and why it is important.

CO 7: State the null hypothesis and alternative hypothesis (both one way and two ways) appropriate to a given scenario.

CO 8: Determine if it is appropriate to use the Chi-Square test for testing the significance of fit between data and predicted data.

CO 9: Perform basic test (Chi-Square test) to evaluate results

Bachelor of Science (Bio-Technology) Semester–II
Session: 2021-22
Biostatistics
Course Code: BBTL-2333

Time: 3 Hours **Max. Marks: 40**
Theory: 32
CA: 8

Instructions for the Paper Setter:
There will be five sections, namely A, B, C, D, E
Section –A: The examiner shall set 10 short answer type questions covering entire syllabus and the candidates will have to attempt 8 questions of 1 mark each. Answer to each question shall be approximately of 50 words.The total weight age of this section shall be 8 marks.
Section-B, C, D, and E: Eight questions of equal marks are to be set, two in each of the four sections (B-E). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt four questions, selecting at least one question from each section. Each question shall carry 6 marks. The total weightage of these sections shall be 24 marks.
The students can use only Non Programmable & Non Storage Type Calculator and statistical tables.

Unit-I

Elementary Statistics: Collection of data. Frequency distribution and its graphical representation. The mean, median, mode, standard deviation, variance, covariance of data.

Unit-II

Probability: Basic concepts, sample space and events, use of counting method in probability, addition law, Multiplication Law, Conditional Probability and Independent Events, Bayes theorem with application (without proof).

Unit-III

Introduction to Correlation & Regression: Scatter diagram, linear correlation, linear regression lines

Unit-IV

Hypothesis Testing: Sample Statistics and parameters, Level of significance, Concept of Null and Alternate Hypothesis, Normal test for single mean (Z-test), Chi-square test (Goodness of fit and association of attributes).

Text Books:

1. Mathematics Textbook for class XI, NCERT.
2. Mathematics, Textbook for class XII, NCERT.

Reference Books
1. S.C Gupta, V.K Kapoor, Fundamentals of mathematical statistics.
2. Mendenhall W. and Sincich T. (1995). Statistics for engineering and sciences (IVth edition). PrenticeHall. And sciences (IVth edition). Prentice Hall.

3. B.A./ B.Sc Part-I (12+3 System of Education) 225 Gupta S.P. (2000). Statistical methods. Sultan Chand and Company, New Delhi.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2484
Zoology-I
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

CO1: Understand the general classification of Animal Kingdom.

CO2: Familiarize with the various classes of animal Kingdom.

CO3: Understand the digestive system, respiratory system, excretory and circulatory system of man..

CO4: Come to know the various effects viz. bohr effect, haldane effect etc.

CO5: Understand the skeletal system, neural integration and endocrine system of man.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2484
Zoology-I
(Theory)

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

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

Unit-I

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

Unit-II

Digestive System: The alimentary canal and associated glands of Man. Digestion of dietary constituents, regulation of digestive processes and absorption. Extra and intracellular 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.

Unit-III

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.

Unit-IV

Skeletal system: Ultrastructure, chemical and physical basis of skeletal muscle contraction.
Neural Integration: Structure and functions of brain, Structure of neuron, resting membrane potential, 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.

Suggested Readings:

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 LifeSciences. Vishal Publishers, Jalandhar.

3. Sobti, R.C. (2005). Introduction to Biotechnology, Part-2, Concepts Tools andApplication, Vishal Publishers.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22

Course Code: BBTM-2484 (P)

Zoology-I

(Practical)

COURSE OUTCOMES

After passing this course the student will be able to:

CO1: Understand the estimation of blood haemoglobin

CO2: Familiarize with the various systems of human such as digestive, arterial, venous and urinogenital systems.

CO3: Record blood pressure and blood groups.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2484
Zoology-I
(Practical)

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

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

Experiments:

1. 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.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2065
Genetics
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand Mendelian and Neo-mendelian genetics

CO2: Study the phenomenon of dominance, laws of segregation, independent assortment of genes.

CO3: Understand the different types of genetic interaction, incomplete dominance, codominance, inter allelic genetic interactions, multiple alleles and quantitative inheritance.

CO4: Develop an understanding of the principles and mechanisms of linkage and crossing over.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2065
Genetics
(Theory)

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

Instructions for the Paper Setter

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

Unit - I

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

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

Unit – II

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

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

Unit – III

Mutation: Spontaneous versus induced mutations, types of mutations, mutations rate and frequency, Mutagens: Physical and Chemical, the molecular basis of mutations. Significance & Practical applications of Mutation

Basic Microbial Genetics: Conjugation, transduction, transformation

Unit – IV

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

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

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2065 (P)
Genetics
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand Mendelian laws.

CO2: Solve Paternity disputes.

CO3: Demonstrate segregation in preserved material.

CO4: Study polytene chromosomes and dermatoglyphics.

CO5: Study mitosis from onion root tips.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2065 (P)
Genetics
(Practical)

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

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

Experiments:

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 fingertip patterns.

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

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2086
Biochemistry – II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Familiarize with biomolecules, enzymes and related Metabolic pathways

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

CO3: Familiarize with enzymes and related mechanism through which they work

CO4: Get acquainted with the concept of bioenergetics and various metabolic processes

CO5: Differentiate between equilibrium and steady state kinetics and analysed simple kinetic data and estimate important parameter (Km. Vmax)

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2086
Biochemistry – II
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

Introduction to metabolism, catabolism, anabolism, Laws of Thermodynamics and living system, Free energy change and direction of metabolism, Characteristics of Metabolic pathways, Compartmentation and Inter-organ metabolism, Regulation & evolution of metabolic pathways

Unit-II

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

Unit-III

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

Unit-IV

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

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

Books Recommended:

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

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

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

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

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

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

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2086(P)
Biochemistry – II
(Practical)

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

CO1: Estimate salivary amylase and acid phosphatase activity.

CO2: Know the Effect of temperature and pH on enzyme activity.

CO3: Determine Km value for the activity of acid phosphatase

CO4: Perform and analyse Competitive and non-competitive inhibition

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2086(P)
Biochemistry – II
(Practical)

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

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

Experiments:

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

Books Recommended:

1. Plummer D.T. (2017) An Introduction to Practical Biochemistry, 3rd Edition Tata McGraw Hill Education.

2. Sawhney, S.K. and Randhir singh (2001). Introductory Practical Biochemistry, Narosa Publishing House.

3. Wilson, K. and Walker, J. (2018). Principles and Techniques of Biochemistry, 8thEdition, McGraw Hill Education.

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2347
General Microbiology-II
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Know the whole process of Natural resistance and Non-specific defense mechanism against microorganisms occurs in the human body

CO3: Have the full knowledge of mechanism of action, its diagnosis and treatment for different Viral, Bacterial & Fungal diseases

CO4: Acquire the best knowledge of Industrial Microbiology

CO5: Describe how biotechnology is used to understand and protect the environment, treat sewage and Domestic waste water treatment

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2347
General Microbiology-II
(Theory)

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Introduction to roles of microbes in environment, Bio-mining, Bioconversion, Bioremediation, and Municipal solid waste transformations.

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2347(P)
General Microbiology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Enumerate the microorganisms by different methods while performing microbiological practices

CO2: Know the real importance of Personal hygiene.

CO3: Identify different fungus by lactophenol staining

CO4: Apply basic knowledge of nutrients to study the Growth curve of different microorganisms

CO5: Acquire skills and competency in microbiological laboratory practices applicable to microbiological research

Bachelor of Science (Bio-Technology) Semester-II
Session: 2021-22
Course Code: BBTM-2347(P)
General Microbiology-II
(Practical)

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

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

Experiments:

1. Enumeration of microorganism. Total vs viable counts.

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

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

4. Identification of fungus by and lactophenol staining.

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

6.Visualization of Streptococcus

7.Waste water management test

Books Recommended:

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

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

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

B.Sc. Bio-Technology Semester-III

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3061
Fundamentals of biotechnology
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

CO1: Know Basic Concept of Biotechnology and recombinant technology

CO2: Understand applications of biotechnology in health care and agriculture

CO3: Know how biotechnology can impact the research and development in industry and food technology.

CO4: Know different Ethical issues pertaining to biotechnology

CO5: Understand the concept of biodegradation, bioremediation and biotransformation

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3061
Fundamentals of Biotechnology
(Theory)

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

Instructions for the Paper Setter

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

UNIT-I

Emergence, scope and basics of biotechnology

Historical perspective, Appraise the interplay of science & technology in the development of biotechnology, Definition and areas of Biotechnology, Overview - DNA, gene, gene expression, Recombinant DNA technology. Role of Bacteria (*E.coli*), Yeast, Viruses (bacteriophages), *Drosophila melanogaster*, *Caenorhabditis elegans*, *Arabidopsis thaliana* as workhorses of biotechnology. Biotechnology Research in India. Biotechnology Institutions in India (Public and Private Sector), Biotech Success Stories, Biotech Policy Initiatives.

UNIT-II

Applications of Biotechnology: An Overview

Applying Biotechnology to Modern life styles: Healthcare – Biopharma : Recombinant human insulin, Recombinant hepatitis B Vaccine; molecular diagnostics : PCR for infectious disease (viral / bacterial), blood screening and genetic testing, Gene therapy (for Alzheimer's disease), genetic counseling); Agriculture & food production (Genetically engineered food, Seed banks, aquaculture); Green biotechnology (Bioremediation, Biofuels, Conservation); Forensics & biodefense; Evo Devo (The development of life and human family tree); careers and employment opportunities in biotechnology**.**

UNIT-III

Bio business and IPRs in Biotechnology

Commercialization of Biotechnology: Concerns and Consequences, Biotechnology Industry Practices & Government regulations, Concept and market potential of Bio business, Requirements and

Objectives of Patent, Patentable and non-patentable inventions, process of writing and filing a patent, patenting genes/ gene fragments /SNPs/ proteins / stem cells. Patents related to bacteria, viruses, fungi and medicinal plants, Plant Breeder's Right. IPR: Introduction, types (Trade secret, Copyright, trademark)

UNIT-IV

Biotechnology & Society

Ethical Issues & Regulating the use of Biotechnology: Human cloning, GM microorganisms, Food & Food ingredients, stem cells; Public Perception of Biotechnology: Consuming GM foods, GMOs and environment, antibiotic resistance; The future of Biotechnology.

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3061(P)
Fundamentals of Biotechnology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn Good lab practices in Biotechnology Laboratory

CO2: Apply principle, working and applications of instruments viz., laminar air flow, autoclave, hot air oven etc.

CO3: Know the Handling and disposal procedure regarding hazardous reagents

CO4: Know different steps in Patent writing

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3061(P)
Fundamentals of Biotechnology
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Good laboratory practices followed in biotechnology laboratory
2. Introduction, use and maintenance of basic equipments in a biotechnology laboratory (Auto-pipettes, weighing balance, pH meter, Water bath, dry bath, Spectrophotometer, centrifuges, light microscope, electrophoretic apparatus, vortex mixer, magnetic stirrer, rocker, laminar hoods, autoclave, sonicator, UV transilluminator, hot air oven, BOD incubator)
3. Handling and disposal of hazardous reagents (acids, carcinogenic chemicals like acrylamide, ethidium bromide) and concept of chemical hoods.
4. Different steps for patent with the help of example.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3062
Immunology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Familiarize with the Immune system

CO2: Know about different immune cells providing immunity

CO3: Inculcate the knowledge of immune response towards microorganisms.

CO4: Have understanding of Major Histocompatibility system in relation to disease susceptibility

CO5: Explain immune system, properties of immune system, types of immunity, different pathways of complement systems

CO6: Understand immunoglobulin structure, types and functions

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3062
Immunology-I
(Theory)

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

Instructions for the Paper Setter

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

Unit-I

Types of immunity-innate and adaptive. Features of immune response-memory. Specificity and recognition of self and non-self. Terminology used in the study of immune system. Active and Passive immunization

Unit-II

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

Unit-III

Introduction of Antigen and Antibody, Epitope (B cell & T Cell epitope), Introduction to Immunogen, Molecular basis of immunogenicity and antigenicity, Factors influencing immunogenicity. Immunoglobulins: classes and structure, affinity and avidity. Antigen-Antibody Interaction. Complement fixing antibodies and complement cascade: Classical, Alternative and Lectin Pathway.

Unit-IV

MHC class I and class II molecules, structure and function of class I and class II MHC molecules. Organization of Major Histocompatibility complex (MHC) and inheritance, regulation of MHC expression and disease susceptibility. T & B Cells and their response, Structure of T-cell antigen receptors: TCR-CD3 complex.

Books Recommended:

1. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). Kuby Immunology, 8th Edition. W.H. Freeman and Company, New York.

2. Delves, P. J., Martin, S. J., Burton, D. R. and Roitt, I.M. (2017). Roitt's Esssential Immunology, Wiley Blackwell Publishers.
3. Paul, W.E. (2012). Fundamental Immunology, 7th Edition, LWW Publishers.
4. Kanfmann, S.H.E., Sher A. and Ahmed, R. (2002). Immunology of Infectious Diseases, ASM Press, Washington, D.C.
5. Roitt, I.M. Brostoff, J. and Male, D.K. (2012). Immunology, 8th Edition, Mosby publishers.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3062(P)
Immunology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Collect blood sample by different methods.

CO2: Calculate Differential leucocyte count, Total leucocytes and RBC count in the given blood sample

CO3: Perform Blood group testing in day to day life

CO4: Perform dye exclusion method to isolate mononuclear cells from peripheral blood

CO5: Perform various immunological techniques.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3062 (P)
Immunology-I
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Blood Group testing.
2. Differential leucocytes count.
3. Total Leucocytes count.
4. Total RBC count
5. Separation of serum & Plasma from blood.
6. Isolation of mononuclear cells from peripheral blood and to check their viability by dye exclusion method.
7. Collection of blood sample by different method.
8. To perform Double immune diffusion.

Books Recommended:

1. Celis, J.E., Hunter, T. and Carter, N (2005). Cell Biology: A laboratory handbook. 3rd Edition,Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4th Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4th Edition, Wiley Blackwell.

Bachelor of Science (Biotechnology) Semester-III
Session: 2021-22
Course Code: BBTM-3083
Chemistry-II
(Theory)

Course outcome:

Students will be able to

CO1: explain the various reactive intermediates.

CO2: explain the bonding between different organic compounds

CO3: explain the effect of various substituents on the reactivity of aromatic compounds

CO4: learn Molecular chirality, enantiomers, the Cahn-Ingold Prelog R-S notational system, Resolution of enantiomers, chiral centres other than carbon.

CO5: understand mechanism of nucleophilic substitution , stereochemistry of SN^2 reactions,

CO6: learn carbocation rearrangements in SN^1 reactions, solvent effects.

Bachelor of Science (Biotechnology) Semester-III
Session: 2021-22
Course Code: BBTM-3083
Chemistry-II
(Theory)

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

Instructions for the Paper Setter

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

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 Organic Chemistry
8. E.L. Eliel, Stereochemistry of carbon compounds.
9. W. Camp, Organic Spectroscopy.
10. F. A. Carey, Organic chemistry

Bachelor of Science (Biotechnology) Semester-III
SESSION: 2021-22
Course Code: BBTM-3083(P)
Chemistry-II
(Practical)

Course outcome:

Students will be able to

CO1.**Detect elements** (N, S and halogens) and **Detect functional groups** (Aldehydes, ketones carbohydrates, hydrocarbons, Amides ,Amines Carboxylic acids and phenols) in simple organic compounds and **prepare their derivatives**.

Bachelor of Science (Biotechnology) Semester-III
Session: 2021-22
Course Code: BBTM-3083(P)
Chemistry-II
(Practical)

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

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

Experiments:

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

- Amides
- Amines
- Carboxylic acids and phenols.

Organic qualitative analysis:

Complete identification including derivation of following organic compounds:

- Aromatic hydrocarbons
- Aldehydes
- Ketones
- Carbohydrates

Books Recommended:

Arthur Vogel (1978), Vogel's Textbook of practical organic chemistry, including qualitative organic analysis, 4th ed., Longman Scientific and Technical

Bachelor of Science (Biotechnology) Semester – III
Session 2021-22
Course Code: BBTM-3074
Botany-II
(Theory)

Course outcome: -

After passing this course the student will be able to:

CO1: Understand the plants and plant cells in relation to water

CO2: Understand the chemical contents of the plant products

CO3: Know the concept and characteristics of antiseptic, disinfectant and their mode of action.

CO4: Know the prevention and control measures of plant diseases and its effect on economy of crops.

Bachelor of Science (Bio-Technology) Semester- III
Session 2021-22
Course Code: BBTM-3074
Botany-II
(Theory)

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

Instructions for the Paper Setter

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

Unit-I

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 casual agents, symptoms, epidemiology and their control measures: 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.

Suggested Readings:

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2ndEd. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5thEd., Academic Press.
7. R.S. Mehrotra and Ashok Aggarwal (2003) Plant Pathology Tata McGraw Hill New Delhi.

Bachelor of Science (Bio-Technology) Semester- III
Session 2021-22
Course Code: BBTM-3074
Botany-II
(Practical)

Course outcome: -

After passing this course the student will be able to develop:

CO1: Practical skill on plants and plant cells in relation to water

CO2: Know the symptoms and control measures of plant diseases and its effect on economy of crops.

Bachelor of Science (Bio-Technology) Semester- III
Session 2021-22
Course Code: BBTM-3074(P)
Botany-II
(Practical)

Time: 3Hrs **Practical: 18**

Instructions for the paper setter: question paper is to be set on the spot jointly by the Internal and External Examiners. Two copies of the same may be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar

Experiments:

1. Estimation of 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 O_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.

Suggested Readings:

1. Salisbury, F.B. and C.W. Ross (1992), Plant Physiology, Wadsworth Publication Company
2. Taiz, L. and Zeiger, E. (2002), Plant Physiology. 3rd Edn., Sinauer Associates
3. Srivastava, H.N. (2005) Plant Physiology, Pardeep Publications.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2ndEd. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5thEd., Academic Press.
7. R.S. Mehrotra and Ashok Aggarwal (2003) Plant Pathology Tata McGraw Hill New Delhi.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3085
Biochemistry-III
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Develop an understanding of Carbohydrates metabolisms in cell

CO2: Understand the Amphibolic nature of Kreb's cycle

CO3: Know Electron transport chain and ATP synthesis occurring inside cell

CO4: Know the concept of bioenergetics, various terminologies related to it and concept of high energy molecules and bonds

CO5: Understand the lipid metabolism occurring inside the cell

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3085
Biochemistry-III
(Theory)

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

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

UNIT-1

Carbohydrate metabolism: - Biosynthesis and degradation of carbohydrates, Glycolysis, gluconeogenesis, feeder's pathways for glycolysis, regulation of carbohydrates metabolism.

UNIT-II

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

UNIT-III

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

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

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

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

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

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

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3085 (P)
Biochemistry-III
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the importance of absorbance maxima

CO2: Determine reducing sugar in the given sample

CO3: Perform spectral analysis of plant pigments

CO4: Separate lipids from wheat grains sample

CO5: Perform thin layer chromatography to separate macromolecules

B.Sc. Biotechnology (Semester-III)
Session: 2021-22
Course Code: BBTM-3085 (P)
Biochemistry-III
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Absorbance curve of two dyes
2. Determination of reducing sugar using 3,5 dinitrosalicylic acid.
3. Spectral analysis of various plant pigments
4. Separation of lipids from wheat grains.
5. Separation of macromolecules using thin layer chromatography.

Books Recommended:

1. Celis, J.E., Hunter, T. and Carter, N (2005). Cell Biology: A laboratory handbook. 3rd Edition,Vol-III, Academic Press, U.K.
2. Stevans, C.D. (2017). Clinical Immunology and Serology: A Laboratory Perspective 4th Edition, F.A Davis Company, Philadelphia.
3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4th Edition, Wiley Blackwell.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3066
Molecular Biology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Study Molecular aspects of genetics.

CO2: Have full understanding of basic mechanism and essential component required for DNA replication in prokaryotic & eukaryotic organisms

CO3: Explain the concept of genetic code, decoding system, codon-anticodon interactions, selection of initiation codons, initiation, elongation, termination and also regulation of translation.

CO4: Know how different genes are expressed and regulated in a cell by using different operon model.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3066
Molecular Biology
(Theory)

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

Instructions for the Paper Setter

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

Unit-I

DNA as genetic material, Structure of DNA, Types of DNA, Modes of Replication of DNA in prokaryotes and eukaryotes, DNA polymerases, the replication complex: Pre-priming proteins, Fidelity of replication. Mechanism of replication.

Unit - II

DNA recombination in prokaryotes and eukaryotes: molecular mechanisms, Holiday Junction model, DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair, Insertion elements and transposons: Bacterial and eukaryotic transposons.

Unit-III

Transcription and RNA processing

RNA structure and types of RNA, Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains, Transcription in eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5’ cap formation, polyadenylation, splicing, rRNA and tRNA splicing.

UNIT IV

Regulation of gene expression and translation

Regulation of gene expression in prokaryotes: Operon concept (inducible and repressible system): lac, his, trp operons, Genetic code and its characteristics, Prokaryotic and eukaryotic translation:ribosome structure and assembly, Charging of tRNA, aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, Inhibitors of translation, Regulation, Posttranslational modifications of proteins

Books Recommended:

1. Adams, R. L. P., Knowler, J. T., and Leader, D. P. (1992). The Biochemistry of Nucleic acids, 11th Edition, Champman and Hall, The New York/London/Tokyo/Melbourne/Madras.

2. Bolsover, S. R., Hyams, J. S., S. Shephard, E. A. and White H. A. (1997). From Genes to Cells., John Wiley and Sons.

3. Krebs, J E, Goldstein, ES, Kilpatrick, ST (2017). Lewin's Gene XII, Jones and Bartlett publishers, Inc.

4. Maulik, S. and Patel, S. D. (1997). Molecular Biotechnology Therapeutic Application and Strategies, John Wiley & Sons.

5. Primrose, SB and Twyman, R. (2010). Principles of Gene Manipulation and genomics, 8th Edition, Wiley Blackwell.

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

7. Pierce, B. (2016). Genetics: A conceptual approach, 6th Edition, WH Freeman.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3066(P)
Molecular Biology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate genomic DNA and RNA from plants

CO2: Perform agarose gel electrophoresis.

CO3: Quantify DNA.

CO4: Do SDS-PAGE electrophoresis of different protein samples.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2021-22
Course Code: BBTM-3066(P)
Molecular Biology
(Practical)

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

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

Experiments

1. Isolation of genomic DNA from plants by CTAB method.

2. Isolation of genomic DNA from blood and perform agarose gel electrophoresis.

3. Quantification and determination of purity of DNA.

4. To perform RNA Isolation from plants.

5. Quantification and determination of purity of RNA.

6. SDS-Page electrophoresis of different protein samples.

Books Recommended:

1. Primrose, SB and Twyman, R. (2010). Principles of Gene Manipulation and genomics, 8th Edition, Wiley Blackwell

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

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

B.Sc. Bio-Technology Semester-IV

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4061
Industrial Biotechnology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the basics of microbial industrial process

CO2: Know about different fermenters, isolation of industrially important microbes and their screening methods

CO3: Understand different Strain Improvement method required for industrial important microbes

CO4: Know Media formulation and its optimization process

CO5: Understand Primary and secondary metabolite production at industrial level

CO6: Know about microbial analysis of Microbial production of fermented food viz. cheese, bread etc. and can perform these things while they go to any industry further.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4061
Industrial Biotechnology-I
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

Introduction: Basic concept of agriculture and food processing as industry. Differences between microbial industrial processes and chemical industrial processes.

Unit-II

Industrially important microbes, screening (primary and secondary), selection and identification. Maintenance and preservation of industrially important microbial cultures.

Unit-III

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

Unit-IV

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

Books Recommended:

1. Wittmann, C. and Liao, J. (2017). Industrial Biotechnology:Products and Processes (Advanced Biotechnology), Vol. 4 Wiley-VCH.
2. Singh B.D. (2016). Biotechnology:Expanding horizons, Kalyani Publishers / Lyall Bk Depot
3. Chakraborty, P.K. (2013). Agro and Industrial Biotechnology, Black Prints
4. Tyagi, N. (2012). Industrial Microbiology and Biotechnology,Agrotech Press.

Casida, L.E.J.R. (2007). Industrial Microbiology, New Age International Publishers

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4061(P)
Industrial Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Measure any bacterial size

CO2: Perform IMVIC test for metabolic characterization of bacteria

CO3: Perform different types of Fermentation

CO4: Isolate nitrate reducing bacteria from the environment

CO5: Determine the mutagenicity of a compound

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4061(P)
Industrial Biotechnology-I
(Practical)

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

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

Experiments

1. Measurement of bacterial size.
2. Metabolic Characterization by IMVIC test
3. Alcoholic and Mixed–Acid Fermentation.
4. Starter culture preparation, evaluation and application.
5. Determination of nitrate reduction by bacteria.
6. To perform an AMES assay to determine the mutagenicity of a compound.

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4062
Immunology-II
(Theory)

COURSE OUTCOMES:

After passing this course, student will be able to

CO1: Familiarize with immune effector mechanisms, hybridoma technology and vaccination

CO2: Have sound knowledge of how immune system deals with various pathogens, different processes and different cell types involved in the prevention of disease.

CO3: Become aware about concept, synthesis and action mechanism of vaccines.

CO4: Perform various immune-diagnostic techniques.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4062
Immunology-II
(Theory)

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

Instructions for the Paper Setter

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

Unit-I

T-cell subsets and surface markers, T-dependent and T-independent antigens, Adjuvants, Monoclonal antibodies: its production and uses.

Unit-II

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

Unit-III

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

Unit-IV

Whole organism vaccine, Types of vaccines: purified macromolecules as vaccine, recombinant antigen vaccine, recombinant vector vaccine, synthetic peptide vaccine, multivalent subunit vaccine, DNA Vaccine, RNA Vaccine.

Books Recommended:

1. Abbas, A.K. Litchman, A.H. and Pillai, S. (2017). Cellular and Molecular Immunology, 9th Edition, Elsevier.

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

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

4. Roitt, I., Brostoff, J. and Male, D. (2001). Immunology, 6th Edition, Mosby.

5. Kanfmann S.H.E., Sher, A., Ahmed, R. (2002). Immunology of infectious Diseases, ASM Press, Washington D.C.

6. Butler, M. (2004). Animal Cell culture and Technology, 2nd Edition, Garland Science.

7. Punt, J., Stranford, S., Johns, P. And Owen, J.A (2018). Kuby Immunology, 8th Edition, W.H. Freeman and Company, New York.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4062(P)
Immunology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Prepare Vaccine chart of child.

CO2: Study Haemagglutination & Haemagglutination inhibition assay.

CO3: Perform Direct and indirect ELISA.

CO4: Perform Double immunodiffusion test.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4062(P)
Immunology-II
(Practical)

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

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

Experiments

1. Preparation of vaccine chart of child, highlighting optional vaccines

2. Haemagglutination assay

3. Haemagglutination inhibition assay

4. Double immunodiffusion test using specific antibody and antigen Line of identity, partial identity and non-identity

5. Single immunodiffusion test using specific antibody and antigen

7. Direct and indirect ELISA

8. To perform Immunoelectrophoresis.

9**.** Separation and purification of IgG antibodies from Serum using protein A column.

Books Recommended:

1. Stevans, C.D. (2003). Clinical Immunology and Serology: A Laboratory Perspective 2nd Edition, F.A Davis Company, Philadelphia.

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

3. Hay, F.C. and Westwood O.M.R. (2002). Practical Immunology, 4th Edition, Wiley Blackwell.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4083
Biochemistry-IV
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Know the main objective of amino acid metabolism and urea cycle

CO2: Have knowledge of importance of essential amino acids, its biosynthesis and their regulation.

CO3: Explain the Biosynthetic pathways of purines and pyrimidines nucleotides

CO4: Explain the Degradative pathways of purines and pyrimidines

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4083
Biochemistry-IV
(Theory)

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

Instructions for the Paper Setters:

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

UNIT-I

Amino Acid Metabolism: 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 feedback 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.

Books Recommended:

1. Jain, J. L., Jain, S. and Jain. N. (2016). Fundamentals of Biochemistry, S. Chand & Company Ltd., New Delhi.

2. Rawn, J.D. (1989). Biochemistry, Niel Patterson Publications, North Carolina.

3. Berg, J.M., Tymoczko, J.L., Gatto, G.L., Stryer, L. (2015). Biochemistry, 4th Edition., W.H. Freeman & Co., San Francisco.

4. Voet, D., Voet, J.G. (2012). Fundamentals of Biochemistry, John Wiley and Sons, New York.

5. Nelson, D.L. and Cox, M.M. (2017). Lehninger's Principles of Biochemistry, 7th Edition.,WH Freeman, New York.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4083(P)
Biochemistry-IV
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Quantitatively estimate amino acids by using Ninhydrin reaction

CO2: Acquire skills to perform protein purification by using salt precipitation

CO3: Isolate casein from milk to determine isoelectric pH of casein

CO4: Check fat content in milk sample

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4083(P)
Biochemistry-IV
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform quantitative estimation of amino acids using Ninhydrin reaction

CO2: Perform purification of protein using salt precipitation

CO3: Isolate casein of milk and determine isoelectric pH of casein

CO4: Determine fat content in milk

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4083(P)
Biochemistry-IV
(Practical)

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

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

Experiments:

1. Quantitative estimation of amino acids using the Ninhydrin reaction.

2. Purification of protein using salt precipitation.

3. Isolation of Casein from milk and Isoelectric pH of casein.

4. Determination of fat content in milk.

5. Estimation of blood cholesterol.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4064
Skill Development in Biotechnology-A
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Detect different food borne infections by different methods

CO2: Test food adulterants Biochemically/ microbiologically.

CO3: Learn all the nutritional aspects of the carbohydrates, lipids & proteins.

CO4: Study the advanced techniques used to determine for food borne pathogens

CO5: Know the potential effects of food spoilage by food borne infectious agents

CO6: Describe the role of biotechnologies in food production and food processing

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4064
Skill Development in Biotechnology-A
(Theory)

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

Instructions for the Paper Setters:

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

Food Biotechnology

Unit-I

Commercial potential of food fermentation industry; Novel food ingredients: Low calorie sweetner, Plant tissue culture and naturally produced flavor modifiers, natural food coloring agents; Neutracuticals: Probiotics, Food spoilage: Detection and mechanism of food borne infections (*Clostridium, Salmonella, Staphylococcus, Aspergillus* sp.)

Unit-II

Introduction to HACCP plan, Preservation: thermal processing, cold preservation, chemical preservatives, food dehydration, food irradiation, biological control; Quality assurance: Biochemical/ microbial testing of food adulterants: milk, butter, oil, jams, jellies, Government regulatory practices and policies (FSSAI, FDA etc.), Food packaging: need and ways (glass, metal, plastics, moulded pulp and aluminium foil).

Dietics and Nutrition Management

Unit III

Energy value of biomolecules: carbohydrates, fats and proteins, basal metabolic rate definition and its measurement, factors affecting BMR, energy requirements of human beings, Energy requirements in

different age groups and special conditions (pregnant ladies and lactating mothers), different dietary types, requirements, utilization and functions.

Unit-IV

Methods of protein determination, amino acid imbalance, protein requirements, utilization and functions, nutritional aspects of vitamins and minerals, food processing and loss of nutrients during processing and cooking, naturally occurring antinutrients, balanced diet, recommended dietary allowances for different categories of human beings, disorders related to nutrition-protein energy malnutrition, starvation and obesity.

Books Recommended:

1. Frazier, W.C. and Westhoff, D.C. (2013). Food microbiology (Tata McGraw-Hill publishing Co. Ltd).

2. Admas, M.R. and Moss, M.O. (2015). Food microbiology, 4th Edition, Royal Society of Chemistry).

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

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

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

6. Michael P. Doyle, Larry R. Beuchat (2007). Food Microbiology: Fundamentals and Frontiers, 3rd Edition, ASM Press.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4064(P)
Skill Development in Biotechnology-A
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Check different food adulterants in the given products.

CO2: Determine Gluten content in wheat flour.

CO3: Give quality index of fats content in different food products

CO4: Calculate BMR

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4064(P)
Skill Development in Biotechnology-A
(Practical)

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

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

Experiments:

1. Detection of Adulteration in food (oil, butter).

2. Determination of crude fibre content in wheat and chickpea.

3. Determination of Gluten content in wheat flour.

4. Isolation of protein concentrates.

5. Determination of fat content in different food products.

6. Determine the BMR.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4065
Fundamentals of Bioinformatics
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand basics of computer and data storage devices

CO2: Understand basics of bioinformatics and sequence alignment

CO3: Know about scoring matrices and database searching

CO4: Know about primary and secondary databases

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4065
Fundamentals of Bioinformatics
(Theory)

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

Instructions for the Paper Setters:

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

UNIT-I

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

UNIT-II

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

UNIT-III

Scoring Matrices: PAM, BLOSUM,

Multiple Sequence Alignment: Progressive Alignment, Iterative Alignment Methods,

Database Searching: BLAST and its types

UNIT-IV

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

Books Recommended:

1. Norton's P. (2017). Introduction to Computing Fundamental, 7th Edition, McGraw Hill Education, New Delhi.
2. Sinha P.K. (2010). Fundamental of Computers, 8th Edition, BPB Publication, New Delhi.
3. Jin Xiong. (2006) Essential Bioinformatics. Cambridge University Press.
4. Baxevais B.F. and Quellette F. (2004). Bioinformatics a Practical Guide to the Analysis of Genes and Proteins, 3rd Edition, Wiley-Interscience

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4065 (P)
Fundamentals of Bioinformatics
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Use and perform MS -office

CO2: Know and use various databases

CO3: Perform Sequence alignment

CO4: Perform prediction of protein functional domain

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4065 (P)
Fundamentals of Bioinformatics
(Practical)

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

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

Experiments:

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

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4486
Zoology-II
(Theory)

Course Outcomes

CO1: Identify the contributions of various Evolutionists.

CO2: Understanding the process and theories in evolutionary biology.

CO3: To aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.

CO4: To increase awareness for the health in students.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4486
Zoology-II
(Theory)

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

Instructions for the Paper Setters:

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

Section–A

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).

Section–B

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

Geological time scale.

Section–C

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.

Section-D

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:

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.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4486 (P)
Zoology-II
(Practical)

Course outcomes

CO1: To aware the students for various parasites and diseases which spreads in human with the help of study of host-parasite relationship.

CO2: To aware about the typhoid, cholera likes disease.

CO3: Understanding of evolutionary phenomena.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTM-4486 (P)
Zoology-II
(Practical)

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

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

Experiments

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:

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.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2021-22
Course Code: BBTT-4067
Industrial/ Institutional Visit

Time: 3 Hours **Max. Marks: 20**

Note:

Students will go for atleast two-week training in industry/institute and the students will be required to submit written report of their training which will be evaluated by the teacher.

B.Sc. Bio-Technology Semester-V

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTL-5061
Patent Laws in Biotechnology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Know the Procedure for obtaining patent.

CO2: Understand the Legal aspects of patenting.

CO3: Understand Patents related to Bacteria, Virus, Fungi and medicinal plants.

CO4: Get knowledge about TRIPs articles relevant to Biotechnology Sector.

CO5: Know about the ethical issues in Biotechnology.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTL-5061
Patent Laws in Biotechnology
(Theory)

Time: 3 Hrs. **Max. Marks: 40**
Theory: 32
CA: 08

Instructions for the Paper Setter

There will be five sections, namely A, B, C, D, E

Section –A: The examiner shall set 10 short answer type questions covering entire syllabus and the candidates will have to attempt 8 questions of 1 mark each. Answer to each question shall be approximately of 50 words.The total weight age of this section shall be 8 marks.

Section-B, C, D, and E: Eight questions of equal marks are to be set, two in each of the four sections (B-E). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt four questions, selecting at least one question from each section. Each question shall carry 6 marks. The total weightage of these sections shall be 24 marks

Unit-I

Introduction to Patent law. First Indian Patent Law and Amendments, History of Indian Patent System, Patentable and Non Patentable Inventions in India, Requirements and objectives of Patent, Patentable subject matter. Procedure for obtaining patent and patenting agencies in India.

Unit-II

Writing a patent, Formats of application and background information, Provisional and Complete Specifications, Types of patent applications, Life of a Patent, Rights of Patentee, Post Grant Opposition, Infringement of Patent, Patent Cooperation Treaty, Patent Offices in India, Sources of Patent Information, Patent literature search.

Unit - III

Patenting in Biotechnology, economic and depository considerations, TRIPs articles relevant to Biotechnology Sector, Patenting Genes, Gene fragments, SNPs, Proteins and Stem cells, Patents related to Bacteria, Virus, Fungi and medicinal plants.

Unit IV

Ethical issues in Biotechnology, Types of risk associated with release of genetically modified microorganisms, Ecological impact, Biosafety, environmental and agricultural concerns, Ethics of Human cloning, reproduction and stem cell research, Legal aspects of patenting

Books Recommended:

1.Singh, I. and Kaur, B (2014) Patent law and Entrepreneurship,Kalyani Publishers

2.Singh, B.D. (2016). Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

3.Singh, I. and Kaur, B (2014) Patent law in Bio-Technology, Kalyani Publishers.

4.Ahuja, V.K (2007) Law Relating to Intellectual Property Rights, 1st Edition.

5.Krishna, S.V. (2007). Bioethics and Biosafety in Biotechnology. New Delhi: New age.

e-Resources:

1. **www.ipindia.nic.in**
2. **https://www.wipo.int/pct/en**
3. **https://www.uspto.gov/learning-and-resources/inventors-enterpreneurs-resources**
4. **https://www.vgtu.lt/library/e-resources/databases/patent/287170**

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTL-5062
rDNA Technology-A
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the concept of rDNA technology and their application in advanced research.

CO2: Know about different DNA Modifying enzymes in rDNA technology

CO3: Know how plasmids can be developed as vector.

CO4: Study different methods of Transformation.

CO5: Study how labelling of DNA and RNA is done

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5062
rDNA Technology-A
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

Introduction to genetic engineering. Why gene cloning and DNA analysis is important. What is clone, how to clone a gene: Overview of the procedure.

Tools in Recombinant DNA Technology: Restriction and modifying enzymes, Type I , Type II and Type III enzymes and their characteristic features; restriction sequences, isoschizomers, rare cutting enzymes, enzyme cutting similar sequence in different manner

DNA Modifying enzymes: Characteristics and applications of Nucleases – DNase and RNase, DNA-Pol I, Klenow fragment, T4DNA polymerase, T7 DNA polymerase, T4 Polynucleotide kinase, Phosphatase, Reverse transcriptase, Taq polymerase and Ligase. Terminal deoxynucleotidyl transferase, reverse transcriptase. RNase-H, DNase-I, Nuclease S-I

Unit-II

Cloning vectors: Basic features of plasmids, antibiotic resistance genes, multiple cloning site, pBR 322, pUC 8, Bacteriophage λ based vectors: insertional and replacement vectors, phagemid, cosmid, fosmid

Isolation and purification of DNA from bacteria, plants, animals and soil.

Unit-III

Gene identification: Nucleic acid hybridization (Southern & Northern blotting), Merits and demerits of nitrocellulose and nylon membranes (N & N+). Methods of Transformation: $CaCl_2$, electroporation, transfection, micro projectile.

Unit-IV

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

Books Recommended:

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

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

3. Brown TA. (2017) Genomes, 4th Edition, Garland Science.

4. Glick, B. R., & Pasternak, J. J (2010). Molecular biotechnology- principles and applications of recombinant DNA. Washington: ASM Press.

5.Clark, D. P. & Pazdernik, N. J. (2009). Biotechnology- applying the genetic revolution. USA: Elsevier Academic Press.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5062(P)
rDNA Technology-A
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate genomic DNA from bacteria.

CO2: Quantify DNA using Spectrophotometer and determine their purity.

CO3: Perform Agarose Gel Electrophoresis.

CO4: Perform and understand concept of restriction digestion

CO5: Perform and understand concept of ligation

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5062(P)
rDNA Technology-A
(Practical)

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

Instructions for the practical Examiner:

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

1. Isolation of genomic DNA from bacteria.
2. To perform spectrophotometric quantification of DNA for determination of purity
3. Restriction enzyme digestion of ~~the~~ isolated DNA with 6, 5 and 4 cutters and Agarose Gel Electrophoresis of the digested fragments.
4. To perform ligation reaction and agarose gel electrophoresis.

Books Recommended:

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

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

3.Brown TA. (2017) Genomes, 4th Edition, Garland Science

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5063
Concepts of Plant Tissue Culture
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Study the macronutrients and micronutrients and their deficiency symptoms in plants.

CO2: Know about the different physiological functions & biosynthesis of major plant growth regulators.

CO3: Understand the concept of Totipotency.

CO4: Understand the different methods of gene transfer in plants.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5063
Concepts of Plant Tissue Culture
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

Introduction to Plant Tissue Culture and its Historical Background, Plant nutrition: macronutrients and micronutrients and their deficiency symptoms. Plant tissue culture media: types, components and their role.

Unit-II

Physiological functions and biosynthesis of major plant growth regulators such as auxins, cytokinins, gibberllins and abscisic acid.

Unit-III

Totipotency, factors affecting cellular totipotency**,** Cell differentiation, Dedifferentiation and redifferentiation of cells. Tissue competency, plant-explant-plant concept. Factors influencing plant tissue culture: Genotypic, physiological, biochemical and other extrinsic factors.

Unit IV

Transgenic Plant Biotechnology: Methods of gene transfer - Direct (Electroporation, Microprojectile, Microinjection, PEG mediated, DEAE Dextran mediated methods) and indirect (agrobacterium mediated gene transfer).

Books Recommended:

1.Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.
2.Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers
3.Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.

4.Smith, RH. (2012) Plant tissue culture: techniques and experiments, Gulf professional publishing

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5063(P)
Concepts of Plant Tissue Culture
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Prepare cotton plugs.

CO3: Prepare stock solutions of Murashige & Skoog (1962) medium.

CO4: Clean glassware, plasticware and contaminated cultures.

CO5: Prepare, sterilize and inoculate the explants.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5063(P)
Concepts of Plant Tissue Culture
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1.To study functions and operations of various instruments required for plant tissue culture (pH meter, autoclave, laminar air-flow, incubators, oven, distillation unit etc).

2.Laboratory design set up for a PTC Laboratory.

3.Cleaning of glassware, plasticware and contaminated cultures.

4.Different types of enclosure used in plant tissue culture. Preparation of cotton plugs.

5.Preparation of stock solutions of Murashige & Skoog (1962) medium.

6.Preparation of Murashige & Skoog's medium from stock solutions.

7.Different sterilization process (Instruments, glassware and thermolabile and thermostable components)

8.Selection, preparation, sterilization and inoculation of explants.

Books Recommended:

1.Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.

2.Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers

3.Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.

4.Smith, RH. (2012) Plant tissue culture: techniques and experiments, Gulf professional publishing

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5064
Animal Tissue Culture
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

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

CO4: Study different safety considerations in ATC laboratory.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5064
Animal Tissue Culture
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit- II

Contamination- sources, Types, monitoring and eradication of contamination, Cross Contamination. Safety considerations in ATC laboratory, Clean Environment – P1, P2, P3,P4 facility and their applications.

Unit-III

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

Unit-IV

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

Books Recommended

1. Gareth, EJ. (2016). Human Cell Culture Protocols, Humara Press.

2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

3. Julio, E., Celis (2006). Cell Biology-A laboratory hand book, Vol. I-IV,Academic Press, New York.

4. Freshney, RT. (2016), Culture of Animal Cells 7th Edition, John Wiley and Sons, New York.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5064(P)
Animal Tissue Culture
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform different Sterilization techniques.

CO2: Prepare Hanks Balanced salt solution.

CO3: Prepare Minimal Essential Growth medium.

CO4: Isolate lymphocytes for culturing.

CO5: Isolate macrophages from blood for culturing.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5064(P)
Animal Tissue Culture
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1.Sterilization techniques: Theory and Practical -Glass ware sterilization -Media sterilization -Laboratory Sterilization

2.Sources of contamination and decontamination measures.

3.Preparation of Hanks Balanced salt solution

4.Preparation of Minimal Essential Growth medium.

5.Isolation of lymphocytes for culturing and perform cell viability test.

6.Isolation of macrophages from blood for culturing

Book Recommended:

1. Freshney, RT. (2016), Culture of Animal Cells. 7th Edition, John Wiley and Sons, New Delhi.

2.Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5065
Bioprocess Engineering-A
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

CO2: Perform assay of various enzymes according to their properties and can analyse their kinetics data.

CO3: Learn about different types of microbial culture

CO4: Know the effect of temperature, pH and inducer on the product synthesis.

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Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5065
Bioprocess Engineering-A
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit-II

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

Unit-III

Introduction to multistage feedback systems: Internal & external feedback systems, effector molecules (Enzyme inhibitors and enzyme activators) and their kinetics, Effect of temperature, pH and inducer on product synthesis.

Unit-IV

Sterilization: Introduction, air and media sterilizations, design of batch sterilization process, Methods of batch sterilization, Del factor, sterilization cycle, continuous sterilization of feeds and liquid wastes, Filter sterilization, sterilization of fermenters.

Books Recommended:

1.Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 2nd Edition., Pergamon Press, Oxford.

2.Young, MY. (2000). Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.

3.Young, MY. (1996). Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.

5.Bailary, JE. and Ollis, DF. (1986). Biochemical Engineering Fundamentals, McGraw Hills, New York.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5065(P)
Bioprocess Engineering-A
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

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

CO3: study the effect of temperature, pH and aeration on microbial growth

CO4: know about the Production an enzyme in a Bioreactor/shaking flask.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5065(P)
Bioprocess Engineering-A
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

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

Books Recommended:

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

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5066
Biophysical & Biochemical Techniques-A
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Gain fundamental knowledge about the basic principles of sedimentation.

CO2: Study the different types of centrifugation machines and rotors.

CO3: Understand the principles of different types of chromatography (Paper, column, ion-exchange etc).

CO4: Understand the principles of single and double beam UV/Visible spectroscopy.

CO5: Understand the basic principle and instrumentation of NMR and ESR.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5066
Biophysical & Biochemical Techniques-A
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

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

Unit - II

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

Unit III

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

Unit IV

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

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman.
5. Mousumi, D. (2011). Tools and techniques of biotechnology. Jaipur, India: Pointer Publisher.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5066(P)
Biophysical & Biochemical Techniques-A
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the concept of differential centrifugation.

CO2: Separate bio-molecules by paper chromatography and thin layer chromatography.

CO3: Separate proteins by ion-exchange column chromatography.

CO4: Separate proteins by affinity column chromatography.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5066(P)
Biophysical & Biochemical Techniques-A
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1.To study **s**edimentation using Swing Out Rotor and Angle Rotor.

2. To study differential centrifugation.

3.To study separation of bio-molecules by paper and thin layer chromatography.

4..Separation of proteins by ion-exchange column chromatography

5.Separation of proteins by affinity column chromatography.

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2020-21
Course Code: BBTM-5087
Physical, Organic & Inorganic Aspects of Spectroscopy-A
(Theory)

Course outcomes:

Students will be able to:

CO1: understand the various regions of electromagnetic spectrum and use of it in spectroscopic studies.

CO2: understand basic features of different spectrometers.

CO3: explain the phenomenon of Fluorescence and Phosphorescence.

CO4: explain the common terms related to UV and IR spectroscopy like Chromophore, auxochromes, force Constant, vibrational Coupling, field Effect.

CO5: use UV and IR spectroscopy data in elucidating the chemical structure of a compound.

CO6: apply the various selection rules of UV and IR Spectroscopy, explain the common terms related to UV and IR spectroscopy like Chromophore, auxochromes, force Constant, vibrational Coupling, field Effect.

CO7: study the UV and IR spectra of different organic compounds.

CO8: calculate λmax of conjugated and α, ß -unsaturated carbonyl compounds and also understand the factors affecting λmax.

CO9: understand the various sampling Techniques used in spectroscopy.

CO10: solve the numerical problems based on UV and IR spectroscopy.

CO11: understand the various Sampling Techniques used in spectroscopy.

CO12: understand the various applications of UV and IR spectroscopy.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2020-21
Course Code: BBTM-5087
Physical, Organic & Inorganic Aspects of Spectroscopy-A
(Theory)

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

Instructions for the Paper Setters:

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

Unit-I

Energy and Electromagnetic Spectrum

Introduction, electromagnetic spectrum and Units, regions of the spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degree of freedom, Frank Condon Principle, Fluorescence and Phosphorescence.

Unit- II

Ultraviolet and Visible Spectroscopy

The energy of electronic excitation, measurement techniques, Beer-Lambert Law, Molar extinction coefficient. Different types of transition noticed in UV spectrum of organic functional groups and their relative energies. Chromophore, auxochromes, Absorption and intensity shifts, Transition probability. Factors affecting $\lambda_{max,}$ Effect of steric hindrance to coplanarity, Solvent Effects.

Unit – III

Infrared Spectroscopy

Vibrational Energy Levels, Selection Rules, Force Constant, Fundamental Vibration Frequencies, Factors influencing Vibrational Frequencies (Vibrational Coupling, Hydrogen Bonding, Electronic effect, Bond Angles, Field Effect) of different functional groups. Sampling Techniques.

Unit – IV

Applications of UV and IR Spectroscopy

Applications of UV spectroscopy, Woodward Fieserrules for calculating λ_{max} of conjugated polyenes and α,ß -unsaturated carbonyl compounds. Applications of IR spectroscopy,Absorption of Common functional Groups, Interpretation of simple IR spectra, Finger print Regions. Simple numerical problems based on UV and IR spectroscopy.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York
2. D.H. Williams and I. Fleming. Spectroscopic Methods in Organic Chemistry.
3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster; Publisher: John Willey and Sons,Inc.
4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer; Publisher : The Benzamine / Cummings Publishing Company Inc.
5. Introduction to Spectroscopy – D. L. Pavia, G. M. Lampman, and G. S. Kriz
   Publisher: Brooks / Cole, a part of cengage learning

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTM-5087(P)
Physical, Organic & Inorganic Aspects of Spectroscopy-A
(Practical)

Course outcomes:

Students will be able to:

CO1: record and compare IR spectra of various organic compounds.

CO2: compare the UV-Vis spectra of various organic compounds.

CO3: do the preparation and IR characterisation of various inorganic compounds.

CO4: verify Beer Lambert Law for different solutions.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2020-21
Course Code: BBTM-5087(P)
Physical, Organic & Inorganic Aspects of Spectroscopy-A
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Record of IR spectra of diethylether, ethyl acetate and butanone and make comparisons.
2. Synthesis and electronic spectral studies of d-d bands of $(Ni(NH_3)_6)Cl_2$ and $(Ni(en)_3)Cl_2$ complexes. A comparison of their electronic spectral with that of $(Ni(H_2O)_6)Cl_2$ for the calculation of 10 Dq values.
3. Convert cyclohexanone to cyclohexanol and hydrazine of cyclohexazone. Compare the UV-Vis and IR spectra of products with that of starting material.
4. Preparation of $(Fe(py)_4(NCS)_2)$ and its IR characterization.
5. Take commercial sample of methyl orange and record it's UV-vis and fluorescence spectra under neutral, acidic and basic medium and make comparisons.
6. To verify Beer- Lambert Law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the concentration of given $KMnO_4$/$K_2Cr_2O_7$ solution.

Bachelor of Science (Bio-Technology) Semester-V
Session: 2021-22
Course Code: BBTS-5068
Term Paper
(Seminar)

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

Term paper on recent advances in Life Sciences using Internet and library based resources. To be presented as hard Copy/CD/Floppy. Viva/ seminar should be conducted by a panel of three internal examiners.

B. Sc. Bio-Technology Semester-VI

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTL-6061
Intellectual Property Rights & Enterpreneurship
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Get the basic information about Intellectual property rights (IPR)

CO2: Understand World Trade Organization and GATT in detail

CO3: Know about World Intellectual Property Organisation and International depository authorities

CO4: Understand the concept of Entrepreneurship

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTL-6061
Intellectual Property Rights & Enterpreneurship
(Theory)

Time: 3 Hrs. **Max. Marks: 40**
Theory: 32
CA: 08

Instructions for the Paper Setter:

There will be five sections, namely A, B, C, D, E

Section –A: The examiner shall set 10 short answer type questions covering entire syllabus and the candidates will have to attempt 8 questions of 1 mark each. Answer to each question shall be approximately of 50 words.The total weight age of this section shall be 8 marks.

Section-B, C, D, and E: Eight questions of equal marks are to be set, two in each of the four sections (B-E). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt four questions, selecting at least one question from each section. Each question shall carry 6 marks. The total weightage of these sections shall be 24 marks

Unit I

Intellectual Property, Introduction to Intellectual Property Rights (IPR), History of IPR in India, Benefits, Problems and Management of IPR, Different forms of protection under IPR: Trade secret, Patents, Plant Breeder Rights and Copyright, Trademark and Geographical indications.

Unit II

Intellectual property and its legal protection in research, design and development, World Trade Organization and its related intellectual property provisions, General Agreement on Tariffs and Trade (GATT), Principles and objectives of GATT, Principles, objectives, structure and functions of WTO

Unit III

Trade related Investment Measures (TRIMs), Trade related aspects of IPR (TRIPS), TRIPS agreement, objectives and principles, Most Favoured Nation (MFN) Principle, Berne convention, Budapest Treaty, International depository authorities, World Intellectual Property Organisation (WIPO)

Unit IV

Entrepreneurship, Characteristics of entrepreneur, Selection of a product line, design and development processes, Plant layout and design, Demand for a given product, Financing of Enterprise, Capital structure, Project inspection

Books Recommended:

1. Singh, I. and Kaur, B (2014) Patent law and Entrepreneurship, 3rd Edition, Kalyani publishers.

2. Ahuja, V.K (2007) Law Relating to Intellectual Property Rights, 1st Edition.

3.Singh, B.D. (2021) Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

e-Resources:

4. **www.ipindia.nic.in**

5. **https://www.wipo.int/pct/en**

6. **https://www.uspto.gov/learning-and-resources/inventors-enterpreneurs-resources**

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6062
rDNA Technology-B
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand basics of cloning and expression vectors.

CO2: Understand the concept of gene amplification.

CO3: Understand different generations of sequencing.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6062
rDNA Technology-B
(Theory)

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

Instructions for the Paper Setter

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

UNIT-I

Shuttle vectors, BAC, role of antibiotics and antibiotics resistance genes in a vector, insertional inactivation, Important components of Expression Vectors, pET28a, pGEX , role of promoter and types of promoter, their induction system and types of host requirements, gene fusion/tags.

UNIT-II

Overview of cloning, genomic cloning in Lambda vector, screening of recombinants, calculating number of clones that have to be screened, Linker, Adapters, cDNA cloning, Different strategies for cDNA cloning- self priming and adaptor/linker methods. Cloning vectors for Eukaryotes (YAC, viral vectors, Ti & Ri plasmids)

UNIT-III

Basics of PCR, primer designing, Various types of PCR, applications of PCR, PCR based methods of site directed mutagenesis (overlap extension and cassette mutagenesis), random mutagenesis and gene cloning

UNIT-IV

DNA Sequencing: Sanger-Coulson method (chain termination method), Maxam- Gilbert method (chemical degradation of DNA), New generation sequencing (Illumina (Solexa) HiSeq), Ion Torrent technology, Single-molecule real-time (SMRT) sequencing by pacific biosciences, Fundamental

concepts & applications of microarray, Phage display and selection of mutant peptides, yeast two hybrid assay.

Books Recommended:

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

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

3. Brown, T.A. (2017) Genomes, 4th Edition, Garland Science.

4. Glick, B. R., and Pasternak, J. J (2003). Molecular biotechnology- Principles and applications of recombinant DNA, ASM Press, Washington.

5.Clark, D. P. and Pazdernik, N. J. (2009). Biotechnology- applying the genetic revolution, Elsevier Academic Press.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6062(P)
rDNA Technology-B
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the role of restriction digestion in cloning

CO2: Understand the concept of transformation

CO3: Amplify genes.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6062(P)
rDNA Technology-B
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Isolation of plasmid DNA
2. Digestion of plasmid with three different restriction enzymes.
3. Preparation of competent cells
4. Transformation of competent cells by CaCl2 method.
5. Confirmation of the transformants for the presence of plasmid.
6. To perform Polymerase chain reaction
7. Expression vector experiment.

Books Recommended:

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

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

3.Brown TA. (2017) Genomes, 4th Edition, Garland Science

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6063
Applications of Plant Tissue Culture
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand basic concepts of Micropropagation.

CO2: Understand the concept of generation of variations in plants.

CO3: Learn important milestones in plant tissue culture.

CO4: Understand the concept of protoplast fusion and somatic cell hybridization and secondary metabolite production

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6063
Applications of Plant Tissue Culture
(Theory)

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

Instructions for the Paper Setter

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

Unit I

Micropropagation methods (axillary bud, shoot-tip and meristem culture), Stages of micropropagation, Factors affecting micropropagation and technical problems, Applications of micropropagation, Acclimatization of tissue culture raised plants. Modes of regeneration, Somatic embryogenesis and organogenesis, Types of somatic embryogenesis, Applications of somatic embryogenesis.

Unit II

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

Unit-III

Protoplast isolation and culture, viability of protoplasts, protoplast fusion, selection of somatic hybrids and cybrids, applications of somatic cell hybridization.

Unit-IV

Cell suspension culture, production of secondary metabolites by plant tissue culture, immobilized plant cell culture, use of bioreactors in secondary metabolite production, transgenic approaches in secondary metabolite production.

Books Recommended:

1. Bhojwani, S.S, and Razdan, M.K. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.

2. Razdan, M.K. (2019) Introduction to Plant tissue culture, Science Publishers.

3. Singh, B.D. (2021) Biotechnology expanding horizons, Kalyani Publishers, New Delhi.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6063(P)
Applications of Plant Tissue Culture
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Perform micropropagation techniques.

CO2: Learn different pathways of plant regeneration under in vitro conditions.

CO3: Understand techniques of establishing cell suspension cultures

CO4: Carry out culture experiments with different explants.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6063(P)
Applications of Plant Tissue Culture
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Micropropagation and its different steps.

2. Significance of growth hormones in culture medium.

3. Induction of callus from different explants.

4. To study regeneration of shoots/embryos.

5. Raising of cell suspension cultures.

6. Anther culture, ovary culture and embryo rescue.

Books Recommended:

1.Taiz, L and Zeiger, E. (2014). Plant Physiology, 6th Edition, Sinauer Associates.

2.Razdan, MK. (2019) Introduction to Plant tissue culture, Science Publishers

3.Bhojwani, SS and Razdan, MK. (2004). Plant Tissue Culture. Theory and Practice, Elsevier.

4.Smith, RH. (2000) Plant tissue culture: techniques and experiments, Gulf professional publishing

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6064
Animal Biotechnology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the basics of animal cell culture.

CO2: Understand about Transfection methods and expression vectors

CO3: Know about Stem cells and their benefit for human benefit.

CO4: Understand the role of genetic engineering in the improvement of animal cell for human welfare.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6064
Animal Biotechnology
(Theory)

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

Instructions for the Paper Setter

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

Unit- I

Commonly used animal cell line, their origin and characteristics (WI-38, MRC-5, IMR-90, HEK-293, HeLa, A 549), Differentiation of cells, Organotypic and histotypic cultures: Organotypic culture: Gas and nutrient exchange, structure integrity, growth, differentiation, advantages and applications. Methods, advantages and applications of histotypic culture. Three dimensional culture and tissue engineering: Concept of tissue engineering, components of tissue engineering, cells imaging in 3D construct.

Unit- II

Transfection methods (calcium phosphate precipitation, DEAE-Dextran- mediated transfection, Lipofection, electroporation, Retroviral infection, Microinjection), Promoters, Expression vectors and detection of transgenics, need to express proteins in animal cells.

Unit- III

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

Unit-IV

Genetic Engineering in Animal Cells: Methodology for Transgenic animals (Mice, rabbit, Cattle, goat, sheep, pigs, Fish) production of regulatory proteins, blood products, vaccines and hormones, Transgenic animal as bioreactor, Animal cloning- IVF & embryo transfer, Benefits and Concerns surrounding the use of animal biotechnology

Books Recommended

1. Gareth, EJ. (1996). Human Cell Culture Protocols, Humara Press.

2. Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

3. Julio, E., Celis (1998). Cell Biology-A laboratory hand book, Vol. I-IV, 2nd Edition, Academic Press, New York.

4. Freshney, RT. (2016), Culture of Animal Cells 7th Edition, John Wiley and Sons, New York.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6064(P)
Animal Biotechnology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Maintain cultures of animal cells and established cell lines with good viability, minimal contamination and appropriate documentation.

CO2: Perform supportive tasks relevant to cell culture, including preparation and evaluation of media, cryopreservation and recovery, and assessment of cell growth and health.

CO3: Recognise and troubleshoot problems common to routine cell culture.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6064(P)
Animal Biotechnology
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Seeding of cell line.

2. Maintenance of a cell line and check doubling time.

3. Isolation of RNA from blood.

4. Observation of adherent (Fibroblastic, epithelial) and suspension cultures (Lymphoblast).

5.To perform trypsinization of cells.

6. Cell counting by haemocytometer

7. Determination of the IC50 value of a drug using MTT assay

Book Recommended:

1. Freshney, RT. (2016), Culture of Animal Cells. 7th Edition, John Wiley and Sons, New Delhi.

2.Butler, M. (2004). The Animal Cell Culture and Technology, IRL Oxford Univ. Press.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6065
Bioprocess Engineering-B
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn about the Design of a Fermenter and how to use it.

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

CO3: Study about different techniques of Downstream Processing.

CO4: Learn about Effluent treatment and fermentation Economics.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6065
Bioprocess Engineering-B
(Theory)

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

Instructions for the Paper Setter

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

Unit-1

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

Unit-II

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

Unit-III

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

Unit-IV

Effluent treatment- Primary, Secondary and Tertiary treatment, aerobic and anaerobic slug treatment process, fermentation economics.

Books Recommended:

1.Stanbury, PF, Whitaker, A. and Hall, SJ. (2016). Principles of Fermentation Technology 2nd Edition., Pergamon Press, Oxford.

2.Young, MY. (2000). Comprehensive Biotechnology (Vol. 1-4), Pergamon Press, Oxford.

3.Young, MY. (1996). Environmental Biotechnology, Principles & Applications, Kluwer Academic Publications, New Delhi.

4.Bailary, JE. and Ollis, DF. (1986). Biochemical Engineering Fundamentals, McGraw Hills, New York.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6065(P)
Bioprocess Engineering-B
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6065(P)
Bioprocess Engineering-B
(Practical)

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

Note:

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

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTM-6066
Biophysical & Biochemical Techniques-B
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Illustrate the working principles electrophoresis techniques and their role in science.

CO2: How to measure radioactivity, instruments used for detecting and measuring radiations.

CO3: Understand the concepts of spectrophotometry and applications of different types of spectrophotometry.

Session: 2021-22
Course Code: BBTL-6066
Biophysical & Biochemical Techniques-B
(Theory)

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

Instructions for the Paper Setter

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

UNIT-I

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

UNIT-II

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

UNIT III

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

UNIT-IV

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

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.
2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.
3. Sheehan, D. (2009). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.
4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman.
5. Mousumi, D. (2011). Tools and techniques of biotechnology. Jaipur, India: Pointer Publisher.

Course Code: BBTM-6066(P)
Biophysical & Biochemical Techniques-B
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn about the qualitative and quantitative analysis of DNA sample

CO2: Prepare standard curve of protein

CO3: Prepare standard curve of DNA

CO4: Separation of bio-molecules by vertical and horizontal gel electrophoresis

Session: 2021-22
Course Code: BBTM-6066(P)
Biophysical & Biochemical Techniques-B
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Preparation of standard curve of protein
2. Preparation of standard curve of DNA.
3. Casting of horizontal gel and Separation of bio-molecules by electrophoresis
4. Casting of Native-PAGE gel and Separation of bio-molecules by electrophoresis.
5. Casting of discontinuous PAGE gel and Separation of bio-molecules by electrophoresis.

Books Recommended:

1. Upadhyay, A., Upadhyay, K. and Nath N. (2016) Biophysical chemistry: Principles and Techniques. Himalaya Publishing House, India.

2. Wilson K. and Walker J. (Eds.) (2010). Practical Biochemistry: Principles and Techniques, Cambridge University Press, U.K.

3. Sheehan, D. (2000). Physical Biochemistry: Principles and Applications, John Wiley and Sons Ltd., Chichester, England.

4. Freifelder, D. (1982). Physical Biochemistry. Applications to Biochemistry & Molecular Biology, W.H. Freeman & Co.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTL-6087
Physical, Organic & Inorganic Aspects of Spectroscopy-B
(Theory)

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

Course outcomes:

Students will be able to:

CO1: explain common terms in NMR spectroscopy such as chemical shift, coupling constant, and anisotropic effect, spin spin splitting, shielding constant and their affect on the spectra of the compound.

CO2: study thevarious measurement techniques in NMR spectroscopy.

CO3: understand the various cleavages and rearrangements in Mass spectroscopy.

CO4: factors affecting cleavage patterns in Mass spectroscopy.

CO5: interpret the spectrum of unknown compounds on the basis of NMR and Mass spectroscopy.

CO6: understand the various applications of NMR and Mass spectroscopy.

CO7: use NMR and Mass spectroscopy data in elucidating the chemical structure of a compound.

CO8: solve the numerical problems based on use NMR and Mass spectroscopy.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTL-6087
Physical, Organic & Inorganic Aspects of Spectroscopy-B
(Theory)

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

Instructions for the Paper Setter

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

UNIT-I

I. Proton Magnetic Resonance spectroscopy (1H NMR)

The Nuclear spin, Larmor frequency, the NMR isotopes, population of nuclear spin level, spin and spin compounds, shielding constant, range of typical chemical Shifts simple application of chemical shifts, Anisotropic effect. Spin spin splitting, Coupling constant.

UNIT-II

II. Applications of NMR spectroscopy

NMR spectra with various examples such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene, o-, m-, p- anisidine, o-, m-, p- nitrophenols, acetophenone.

Simple numerical of structure elucidation of NMR spectroscopic data.

UNIT- III

III. Mass Spectrometery

Basic Principles Elementary theory. Molecular ions, isotope ions, fragment ions of odd and even electron types, Nitrogen rule, Factors affecting cleavage patterns, simple cleavage, cleavages at a hetero atom, multicentre fragmentations, rearrangements, diels – alder fragmentation, Mc Lafferty rearrangement.

UNIT- IV

IV. Applications of Mass Spectroscopy

Cleavage associated with common functional groups , Aldehydes, ketones cyclic and acyclic

esters, alcohols, olefins, aromatic compounds amines, Interpretation of the spectrum of unknown simple molecules.

Books Recommended:

1. Organic Spectroscopy By W. Kemp; Publisher- Palgrave, New York

2. D.H. Williams and I. Fleming.Spectroscopic Methods in Organic Chemistry.

3. Spectrometric Identification of Organic Compounds - R.M. Silverstein & F. X. Webster;

Publisher: John Willey and Sons,Inc.

4. Introductory Problems in Spectroscopy- By R.C. Banks, E.R. Matjeha and G. Mercer;

Publisher : The Benzamine / Cummings Publishing Company Inc.

5. Introduction to Spectroscopy – D. L. Pavia, G. M. Lampman, and G. S. Kriz

Publisher: Brooks / Cole, a part of cengage learning

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTL-6087 (P)
Physical, Organic & Inorganic Aspects of Spectroscopy-B
(Practical)

Course outcomes:

Students will be able to:

CO1: interpret the spectrum of unknown compounds on the basis of NMR spectroscopy.

CO2: use NMR data in elucidating the chemical structure of a compound.

CO3: understand the concept of Green Chemistry and will be able to use green approach in preparation of organic compounds.

CO4: understand the concept of chromatography and its applications in separation of various components of the given mixture.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTL-6087 (P)
Physical, Organic & Inorganic Aspects of Spectroscopy-B
(Practical)

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

Instructions for the practical Examiner:

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

Experiments:

1. Record ^{1}H NMR spectra of ethylacetate and ethyl acetoacetate (in $CDCl_3$ or CCl_4) and show the presence of tautomeric structures.

2. Preparation of benzillic acid from benzaldehyde.

3. Separation of components of spinach using column chromatography.

4. Prepare p-nitroacetanilide and make comparison of ^{1}H NMR spectra data of aniline,acetanilide (starting material) and p-nitroacetanilide (product).

5. Compare the IR and ^{1}H NMR spectra of aspirin and salicylic acid.

Bachelor of Science (Bio-Technology) Semester-VI
Session: 2021-22
Course Code: BBTT-6088
Educational Tour and Written Illustrated Reports

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

Instructions:

Viva should be conducted by a panel of three internal examiners.