FACULTY OF LIFE SCIENCES

SYLLABUS

Of

Bachelor of Science Bio-Technology (Semester: III-IV)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2024-25

The Heritage Institution
KANYA MAHA VIDYALAYA
JALANDHAR
(Autonomous)

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

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

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

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

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

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

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

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

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2024-25

Semester-III

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL-3061	Fundamentals of Biotechnology	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-3062	Immunology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-3083	Chemistry-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-3074	Botany-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-3085	Biochemistry-III	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-3066	Molecular Biology	C	3-0-0	3-0-0	3	60	-	15	75
BBTP-3067	Lab in Fundamentals of Biotechnology	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-3068	Lab in Immunology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-3089	Lab in Chemistry-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-3070	Lab in Botany-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-3081	Lab in Biochemistry-III	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-3062	Lab in Molecular Biology	C	0-0-2	0-0-1	1	-	20	5	25
AECE-3221	*Environmental Studies	C	2-0-0	2-0-0	2	30	10	10	50
SECP-3512	*Personality Development	AC	2-0-0	2-0-0	2	40	-	10	50
				Total Credits	26				

[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

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

C-Compulsory

AC- Audit course

Kanya Maha Vidyalaya, Jalandhar (Autonomous)

SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE PROGRAMME

Bachelor of Science (Bio-Technology)

Session: 2024-25

Semester-IV

Course No.	Course Title	Course Type	Credit hours	Credits L-T-P	Total Credits	L	P	CA	Total Marks
BBTL-4061	Industrial Biotechnology-I	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-4062	Immunology-II	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-4083	Biochemistry-IV	C	3-0-0	3-0-0	3	60	-	15	75
BBTL-4064	Skill Development in Biotechnology	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-4065	Fundamental of Bioinformatics	C	2-0-0	2-0-0	2	40	-	10	50
BBTL-4486	Zoology-II	C	2-0-0	2-0-0	2	40	-	10	50
BBTP-4067	Lab in Industrial Biotechnology-I	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-4068	Lab in Immunology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-4089	Lab in Biochemistry-IV	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-4060	Lab in Skill Development in Biotechnology	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-4061	Lab in Fundamental of Bioinformatics	C	0-0-2	0-0-1	1	-	20	5	25
BBTP-4482	Lab in Zoology-II	C	0-0-2	0-0-1	1	-	20	5	25
BBTF-4063	Industrial/ Institutional Visit	C	0-0-2	0-0-1	1	-	20	5	25
SECS-4522	*Social Outreach	AC	0-0-4	0-0-2	2	-	40	10	50
				Total Credits	24				

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

C-Compulsory

AC- Audit course

B.Sc. Bio-Technology Semester-III

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTL-3061
Course title: Fundamentals of Biotechnology
(Theory)

COURSE OUTCOMES

After passing this course the student will be able to:

CO1: Know the basic concept of biotechnology and recombinant technology.

CO2: Understand applications of biotechnology in health care and agriculture.

CO3: Know the bio business and intellectual property rights in biotechnology.

CO4: Know different ethical issues pertaining to biotechnology.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTL-3061
Course title: Fundamentals of Biotechnology
(Theory)

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

L-T-P: 3-0-0

Instructions for the Paper Setter

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. Each question carries 12 marks.

UNIT-I

Emergence, scope and basics of biotechnology

Historical perspective, Appraise the interplay of science and 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 and 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 and 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: 2024-25
Course Code: BBTL-3062
Course title: 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: Understand Major Histocompatibility system in relation to disease susceptibility

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTL-3062
Course title: Immunology-I
(Theory)

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

L-T-P: 3-0-0

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 12 marks.

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 and 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: 2024-25

Course code: BBTL-3083

Course title: Chemistry-II
(Theory)

Course outcome:

Students will be able to

CO1: explain the various reactive intermediate and explain the bonding between different organic compounds

CO2: explain the effect of various substituents on the reactivity of aromatic compounds

CO3: learn Molecular chirality, enantiomers, the Cahn-Ingold Prelog R-S notational system, Resolution of enantiomers, chiral centres other than carbon.

CO4: understand mechanism of nucleophilic substitution, stereochemistry of SN^1 and SN^2 reactions

Bachelor of Science (Bio-Technology)
(Semester-III)
SESSION: 2024-25
Course code: BBTL-3083
Course title: Chemistry-II
(Theory)

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

L-T-P: 2-0-0

Instructions for the Paper Setters:

Eight questions of equal marks (8 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 8 marks.

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

Nucleophilic substitution :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 (Bio-Technology) Semester- III
Session 2024-2025
Course Code: BBTL-3074
Course title: Botany-II
(Theory)

Course outcome: - After passing this course the student will be able to:

CO1: Understand the nutrition, Transport and Stress responses in plants.

CO2: Understand the physiology of photosynthesis.

CO3: Know the concept of plant pathology and its effect on economy of crops.

CO4: Understand the concept of biodiversity and phytogeography.

Bachelor of Science (Bio-Technology) Semester- III
Session 2024-2025
Course Code: BBTL-3074
Course title: Botany-II
(Theory)

Total marks: 50

LTP: 2-0-0 **Theory: 40**
Time: 3 Hrs. **CA: 10**

Instructions for the Paper Setters:
Eight questions of equal marks (16 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. Each question carries 8 marks.

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; CO2 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 Ross, C.W. 2017. Plant Physiology (4th Edition). Wadsworth PublishingCo., California, USA.
2. Taiz, L. and Zeiger, E. (2022). Plant Physiology (7th Edition). Sinauer Associates Inc. USA.
3. Srivastava, H. N. (2019). Plant Physiology, Biochemistry and Biotechnology. Pradeep Publications, Jalandhar.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2nd Ed. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5th Ed., Academic Press.
7. Sharma, P.D.Plant Pathology. India: RastogiPublication, 2011. Print.
8. Sharma, P.D.Ecology and Environment. 8thed. India: Rastogi Publications, 2010. Print.
9. Hopkins, W.G. and Huner, A.Introduction to Plant Physiology. 4thed. USA: John Wiley and Sons, 2008. Print.
10. Shibu, J., Singh, H.P., Batish, D.R. and Kohli, R.K.Invasive Plant Ecology.New York, USA: CRC Press, Taylor and Francis Group, BocaRaton, 2013. Print.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTL-3085
Course title: 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 basics of Kreb's cycle and electron transport chain.

CO3: Know the concept of lipid catabolism and its regulation

CO4: Understand the various pathways for lipid anabolism along with cholesterol metabolism

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTL-3085
Course title: Biochemistry-III
(Theory)

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

L-T-P: 3-0-0

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 12 marks.

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 digestion, absorption and transport. Lipid Catabolism: Oxidation of fatty acids (Alpha, Beta, Omega oxidation), degradation of triacylglycerol, phosphoglycerides, sphingolipids, regulation of lipid metabolism.

UNIT-IV

Lipid anabolism: Synthesis of fatty acids, triacylglycerol, phosphoglycerides, sphingolipids, cholesterol, and regulation of cholesterol metabolism.

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: 2024-25
Course Code: BBTL-3066
Course title: Molecular Biology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand genetic material of a cell and DNA replication.

CO2: Know the basics of DNA recombination

CO3: Understand transcription and RNA processing

CO4: Know genes expression and regulation in a cell.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTL-3066
Course title: Molecular Biology
(Theory)

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

L-T-P: 3-0-0

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 12 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: 2024-25
Course Code: BBTP-3067
Course title: Lab in 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: Learn principle, working and applications of instruments.

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: 2024-25
Course Code: BBTP-3067
Course title: Lab in Fundamentals of Biotechnology
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

1. 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: 2024-25
Course Code: BBTP-3068
Course title: Lab in 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 Count and RBC count in the given blood sample

CO3: Perform blood group testing

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

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTP-3068
Course title:Lab in Immunology-I
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

1. Collection of blood sample by different methods.
2. Blood group testing.
3. Differential Leucocytes Count.
4. Total Leucocytes Count.
5. Total RBC count
6. Separation of serum and plasma from blood.
7. Isolation of mononuclear cells from peripheral blood and to check their viability by dye exclusion method.

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: 2024-25
Course code: BBTP-3089
Course title: Lab in Chemistry-II

Course outcome:

Students will be able to

CO1.Detect elements (N, S and halogens) in simple organic compounds

CO2: Detect functional groups (Aldehydes, ketones carbohydrates, hydrocarbons, Amides, Amines, Carboxylic acids, and phenols) in simple organic compounds

CO3: Prepare the derivatives of organic compounds.

CO4: Confirm the unknown organic compounds by determining its M.P.

Bachelor of Science (Biotechnology)
(Semester-III)
SESSION: 2024-25
Course code: BBTP-3089
Course title: Lab in Chemistry-II

Exam Time: 3 Hours **Max. Marks: 25**

Credit (L-T-P): 0-0-1 **(Practical: 20, CA: 05)**

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.

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 (Bio-Technology) Semester- III
Session 2024-2025
Course Code: BBTP-3070
Course title: Lab in Botany-II

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: Estimate the oxygen level evolved during photosynthesis.

CO3: Understand the practical skills on separation of plant pigments.

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

Bachelor of Science (Bio-Technology) Semester- III
Session 2024-2025
Course Code: BBTP-3070
Course title: Lab in Botany-II
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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 O2 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 Ross, C.W. 2017. Plant Physiology (4th Edition). Wadsworth Publishing Co., California, USA.
2. Taiz, L. and Zeiger, E. (2022). Plant Physiology (7th Edition). Sinauer Associates Inc. USA.
3. Srivastava, H. N. (2019). Plant Physiology, Biochemistry and Biotechnology. Pradeep Publications, Jalandhar.
4. Pandey, B.P. (2014) Plant Pathology, S Chand.
5. M.J. Carlile, S.C. Watkinson & G.W. Gooday (2001), The Fungi 2nd Ed. Academic Press.
6. G.N. Agrios (2008), Plant Pathology 5th Ed., 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: 2024-25
Course Code: BBTP-3081
Course title: Lab in Biochemistry-III
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the importance of absorbance maxima

CO2: Determine sugar in the given sample

CO3: Perform spectral analysis of plant pigments

CO4: Separate lipids and other macromolecules from a given sample

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTP-3081
Course title: Lab in Biochemistry-III
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

Instructions for the practical Examiner:

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

Experiments:

1. Carbohydrate estimation by Dubois method.

2. Determination of reducing sugar using 3,5 dinitrosalicylic acid.

3. (a) Absorbance curve of two dyes

(b) 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: 2024-25
Course Code: BBTP-3062
Course title: Lab in Molecular Biology
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate genomic DNA and RNA from given samples.

CO2: Perform agarose gel electrophoresis for a given DNA sample.

CO3: Quantify and determine purity of RNA and DNA.

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

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: BBTP-3062
Course title: Lab in Molecular Biology
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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

Experiments

1. Isolation of 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.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: AECE-3221
Course title: Environmental Studies
(Theory)

COURSE OUTCOMES:

After passing this course, students will be able to:

CO1. Understand the concept and need of environmental education.

CO2. Understand the role of an individual in conservation of natural resources.

CO3. Learn about role of major Eco system and their conservation.

CO4. Develop desirable attitude, value and respect for protection of Biodiversity.

CO5. Learn about the control measure of pollution and solid waste management.

CO6. Understand the role of different agencies in the protection of environment.

CO7. Knowledge regarding welfare programmes and Human rights.

CO8. Knowledge about the applied value of environmental studies.

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: AECE-3221
Course title: Environmental Studies (Compulsory)
(Theory)

Time: 3 Hrs. **Max. Marks: 50**
Credit: 2-0-0 **Theory: 30**
Practical: 10
CA: 10

Instructions for the Paper Setter:

The question paper should carry 30 marks. The structure of the question paper being:

Part-A: Attempt any five questions out of seven. Each question carries 2 marks. Answer to each question should not exceed 1 page

Part-B, Essay type with inbuilt choice – 20 marks

Attempt any five questions out of eight. Each question carries 4 marks. Answer to each question should not exceed 3 pages.

Unit I

The multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness

Unit II

Natural Resources: Renewable and non-renewable resources

Natural resources and associated problems.

(a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

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

Unit III

Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids
- Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

Unit IV

Biodiversity and its conservation

- Introduction – Definition: genetic, species and ecosystem diversity
- Biogeographical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values
- Biodiversity at global, national and local levels

- India as a mega-diversity nation
- Hot-spots of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts
- Endangered and endemic species of India
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

Unit V

Environmental Pollution

Definition

- Causes, effects and control measures of Air pollution, Water pollution, Soil pollution , Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution
- Solid waste management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides

Unit VI

Social Issues and the Environment

- From unsustainable to sustainable development
- Urban problems and related to energy
- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people; its problems and concerns. Case studies.
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- Wasteland reclamation
- Consumerism and waste products

- Environmental Protection Act, 1986
- Air (Prevention and Control of Pollution) Act, 1981
- Water (Prevention and control of Pollution) Act, 1974
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

Unit VII

Human Population and the Environment

- Population growth, variation among nations
- Population explosion – Family Welfare Programmes
- Environment and human health
- Human Rights
- Value Education
- HIV / AIDS
- Women and Child Welfare
- Role of Information Technology in Environment and Human Health
- Case Studies

Unit VIII

Field Work

- Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- Visit to a local polluted site – Urban / Rural / Industrial / Agricultural
- Study of common plants, insects, birds
- Study of simple ecosystems-pond, river, hill slopes, etc

References:

1. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
2. Down to Earth, Centre for Science and Environment, New Delhi.
3. Heywood, V.H. & Waston, R.T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
4. Joseph, K. & Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
5. Kaushik, A. & Kaushik, C.P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
6. Rajagopalan, R. 2011. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
7. Sharma, J. P., Sharma. N.K. & Yadav, N.S. 2005. Comprehensive Environmental Studies, Laxmi Publications, New Delhi.
8. Sharma, P. D. 2009. Ecology and Environment, Rastogi Publications, Meerut
9. State of India's Environment 2018 by Centre for Sciences and Environment, New Delhi
10. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi

Bachelor of Science (Bio-Technology) Semester-III
Session: 2024-25
Course Code: SECP-3512
Course title: Personality Development
(Theory)

Course duration: 30 hours

Course credits: 2

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

- To re-engineer attitude and understand its influence on behaviour.
- To develop inter-personal skills and be an effective goal-oriented team player.
- To develop communication and problem solving skills.
- To develop professionals with idealistic, practical and moral values.

LEARNING OUTCOMES

- On completion of the course, students will be able to hone their personality by
- Realisation of the importance and incorporation of positive thinking and attitude in life
- Enhacement of self confidence and analysis of self capabilities
- Learning the different communication skills for self expression
- Effective use of time to combat stress and increase in productivity
- Enhancing personality by physical grooming and fitness
- Understanding the role of design principles and appropriateness of apparel
- Incorporating social etiquettes in daily life and conduct
- Excelling in decision making and leadership qualities

CURRICULUM

Course credits-2 **Total Contact Hours-30**

MODULE	TITLE	HOURS
1.	**Positive Thinking & Attitude**	2
2.	**Self Analysis & Self Confidence**	2
3.	**Communication Skills**	10
	• **Basic Communication Skills** • **Body Language** • **Interview Skills** • **Résumé Writing** • **Group Discussion** • **Telephone and E-mail etiquette** • **Public Speaking**	
4.	**Time Management**	2
5.	**Stress and Conflict Management**	2

6.	**Physical Fitness and Personal Grooming**	**2**
7.	**Appropriateness of Apparel**	**2**
8.	**Social Etiquette**	**2**
9.	**Decision Making process & Problem Solving Skills** • **Leadership Skills** • **Goal Setting** • **Motivation**	**5**
10.	**Closure**	**1**

EXAMINATION

1. Total marks of the course will be 25 (Final Examination: 20 Marks; Internal Assessment: 5Marks)
2. The pattern of the final examination will be multiple choice questions. 25 multiple choice type questions will be set. The student shall attempt 20 questions. Each question will carry 1 mark (20 X 1 = 20). Total time allotted will be 1 hour.
3. Internal Assessment will consist of Attendance: 2 Marks, Internal: 3 Marks.(Total Internal Assessment:5 Marks)

MODULE 1: Positive Thinking & Attitude

- Factors Influencing Attitude
- Essentials to develop Positive Attitude
- Challenges & lessons from Attitude

MODULE 2: Self Analysis & Self Confidence

- Who am I
- Importance of Self Confidence
- SWOT Analysis

MODULE 3: Communication Skills

(i) Basic Communication Skills

- Speaking skills
- Listening skills
- Presentation skills

(ii) Body Language

- Forms of Non-Verbal Communication
- Interpreting body language clues
- Effective use of body language

(iii) Interview Skills

- Type of Interviews
- Ensuring success in job interviews
- Appropriate use of Non-verbal Communication

(iv) Résumé Writing

- Features
- Different types of résumé for Different posts

(v) Group Discussion

- Difference between Group discussion and debate
- Importance of Group Discussion
- Group Decision
- Ensuring success in group discussions

(vi) Telephone & E-mail Etiquette

- Telephone etiquette
- E-mail etiquette

(vii) Public Speaking

- Introductory speech
- Informative speech
- Persuasive speech
- Extempore session

MODULE 4: Time Management

- Importance of time management
- Values & beliefs
- Goals and benchmarks – The ladders of success
- Managing projects and commitments
- Prioritizing your To-do's
- Getting the results you need

MODULE 5: Stress & Conflict Management

- Introduction to stress
- Types of stressors
- Small changes and large rewards
- Stress prevention
- Overcoming unhealthy worry
- Stress at home and workplace
- Dealing with frustration and anger
- Stress reducing exercises
- Understanding conflicts
- Violent and Non-violent conflicts
- Source of conflict
- Structural and cultural violence

MODULE 6: Physical Fitness and Personal Grooming

- Fitness and exercise
- Balanced & healthy diet
- Skin care & Hair care
- Make-up skills

MODULE 7: Appropriateness of Apparel

- Apparel & Personality
- Psycho-social aspects of apparel

- Style-tips for smart dressing & effective use of design elements

MODULE 8: Social Etiquette

- Civic Sense
- Workplace skills
- Meeting and greeting people
- Table Setting and table manners

MODULE 9: Decision Making Process and Problem Solving Skills

- Anatomy of a decision
- How to use problem solving steps and problem solving tools
- How to distinguish root causes from symptoms to identify right solution for right problems
- How to improve problem solving and decision making by identifying individual problem solving styles
- The creative process for making decisions
- Tools to improve creativity
- Implementing the decision – Wrap up

(i) Leadership Skills

- Handling peer pressure and bullies
- Team work
- Decision making
- Taking initiatives

(ii) Goal Setting

- Wish list
- SMART goals
- Blueprint for success
- Short-term, Long-term, Life-term Goals

(iii) Motivation

- Factors of motivation
- Self talk
- Intrinsic & extrinsic motivators

Books Recommended

1. Rossi, P. (2011). *Everyday Etiquette: How to navigate 101 common and uncommon social situations*. St Martins Pr.
2. Pietrzak, T.,& Fraum, M. (2005). *Building career success skills*. ASTD Press.
3. Treffinger, D.J., Isaksen, S.G., & Brian, K. (2005). *Creative problem solving: An Introduction*.
4. Carr, A. (2004). *Positive Psychology: The science of happiness and human strengths*. Burnner-Routlrdge.
5. Oberg, B.C. (1994). *Speech craft: An Introduction to public speaking*. Meriwether Publishing.

B.Sc. Bio-Technology Semester-IV

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4061
Course title: Industrial Biotechnology-I
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Understand the basics of microbial industrial processes.

CO2: Understand the isolation, maintenance, and preservation of industrially important microbes

CO3: Understand different strain improvement method required for industrial important microbes

CO4: Understand industrial production of primary and secondary metabolite and fermentation of dairy products, fermented foods, and enzymes.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4061
Course title: Industrial Biotechnology-I
(Theory)

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

L-T-P: 3-0-0

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 12 marks.

Unit-I

Introduction: Basic concept of agriculture and food processing as industry, methods and principles of food processing, differences between microbial industrial processes and chemical industrial processes.

Unit-II

Industrially important microbes, screening (primary and secondary methods), 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. Fermented foods-Pickles, Sauerkraut, Enzyme production-Amylases, cellulases, proteases in leather 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.

5. Casida, L.E.J.R. (2007). Industrial Microbiology, New Age International Publishers
6. Okafor N, Okeke B.C. (2018). Modern Industrial Microbiology and Biotechnology, 2nd edition, CRC Press.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4062
Course title: Immunology-II
(Theory)

COURSE OUTCOMES:

After passing this course, student will be able to

CO1: Familiarize with antigens and antibodies.

CO2: Understand different types of immunodiffusion techniques.

CO3: Have sound knowledge of how immune system deals with various pathogens, and different cell types involved in the prevention of disease.

CO4: Know about the concept, synthesis, and action mechanism of vaccines.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4062
Course title: Immunology-II
(Theory)

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

L-T-P: 3-0-0

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 12 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 immunodiffusions and immunoelectrophoretic procedures. Immunoblot, ELISA, RIA, agglutination of pathogenic bacteria, Hemagglutination and hemagglutination 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: 2024-25
Course Code: BBTL-4083
Course title: Biochemistry-IV
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Know the basics of amino acid biosynthesis and their regulation.

CO2: Have knowledge of degradation pathways of amino acids along with disorders of amino acid metabolism

CO3: Understand the biosynthetic pathways of purines and pyrimidines nucleotides

CO4: Know the degradative pathways of purines and pyrimidines

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4083
Course title: Biochemistry-IV
(Theory)

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

L-T-P: 3-0-0

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 12 marks.

UNIT-I

Amino acid metabolism: Overview of amino acid metabolism. Glucogenic and ketogenic amino acids. Biosynthesis of essential amino acids, regulation of amino acid biosynthesis by feedback inhibition

UNIT-II

Amino acid metabolism: Transamination reactions of amino acids, deamination and decarboxylation reactions, role of pyridoxal phosphate, urea cycle and inherited defects of urea cycle. Catabolism of essential amino acids, disorders of amino acids metabolism, phenylketonuria, alkaptonuria, maple syrup urine disease, methylmalonic academia (MMA), homocystinuria

UNIT-III

Nucleic acid metabolism: Structure of purine and pyrimidine bases, nucleosides, and nucleotides. Biologically important nucleotides. Biosynthesis of purines and pyrimidines nucleotides. Clinical significance of purine biosynthetic pathway.

UNIT-IV

Nucleic acid metabolism: Degradation of purines and pyrimidines, nucleotides, salvage pathway, regulation of nucleotide biosynthesis.

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: 2024-25
Course Code: BBTL-4064
Course title: Skill Development in Biotechnology
(Theory)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Acquire the knowledge of food fermentation industry

CO2: To gain the knowledge about various adulterants in food along with principles of government regulatory bodies

CO3: Understand the nutritional aspects of the biomolecules, balanced diet and disorders related to nutrition.

CO4: Understand food spoilage and detection

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4064
Course title: Skill Development in Biotechnology
(Theory)

Time: 3 Hours **Max. Marks: 50**

Theory: 40
CA: 10

L-T-P: 2-0-0

Instructions for the Paper Setter

Eight questions of equal marks 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 8 marks.

Food biotechnology

Unit-I

Commercial potential of food fermentation industry; novel food ingredients: Low calorie sweetener, plant tissue culture and naturally produced flavor modifiers, natural food coloring agents; nutraceuticals: 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, molded pulp, and aluminium foil).

Dietetics 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. 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 anti-nutrients, balanced diet, recommended dietary allowances for different categories of human beings, disorders related to nutrition-protein energy malnutrition, starvation, and obesity.

Unit-IV

Food spoilage and detection

Intrinsic and extrinsic factors responsible for food spoilage, microorganisms involved in food spoilage: fruits, vegetables, meat, eggs, bread, methods of detection of food spoilage: Traditional approaches: SCP, Breeds smear, identification of specific organisms by using selective and differential media. New approaches: use of gene probes, RDT, bioluminescence.

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: 2024-25
Course Code: BBTL-4065
Course title: 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: 2024-25
Course Code: BBTL-4065
Course title: Fundamentals of Bioinformatics
(Theory)

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

L-T-P: 2-0-0

Instructions for the Paper Setter

Eight questions of equal marks 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 8 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: 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: 2024-25

Course Code: BBTL-4486

Course Title: Zoology-II

(Theory)

Course Outcomes

After passing this course the student will be able to:

CO1 Understand evolution of Prokaryotes and Eukaryotes.

CO2 Understand the process and theories in evolutionary biology.

CO3 Aware the students about various pathogenic protozoans and helminths and diseases caused by them in humans.

CO4 Understand diseases caused by arthropod vectors and their control measures.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTL-4486
Course Title: Zoology-II
(Theory)

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

L-T-P: 2-0-0

Instructions for the Paper Setters:

Eight questions of equal marks (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. Each question carries 8 marks.

Unit-1

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

Evolution of Prokaryotes and Eukaryotes (unicellularity to multicellularity).

Unit-2

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

Geological time scale.

Unit-3

Introduction to Parasitology (pertaining to various terminologies in use).

Brief account of Life history, mode of infection and pathogenicity of the following

pathogens with reference to man, prophylaxis and treatment.

Pathogenic Protozoans: Entamoeba, Trypanosoma, Giardia and Plasmodium.

Pathogenic Helminths: Tape Worm, Ascaris and Ancylostoma.

Unit-4

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: 2024-25
Course Code: BBTP-4067
Course title: Lab in Industrial Biotechnology-I
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Isolate milk protein and determine fat content in milk

CO2: Learn the process of cheese making

CO3: Isolate microbes from soil

CO4: Screen industrially important enzyme producing microbes

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4067
Course title: Lab in Industrial Biotechnology-I
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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

Experiments

1. Isolation of casein from milk and isoelectric pH of casein.
2. Cheese making by bacterial culture method
3. Determination of fat content in milk.
4. Isolation and screening of amylase producing microbes from soil.
5. Isolation and screening of protease producing microbes from soil.
6. Isolation and screening of cellulase producing microorganism from wood degrading soil.

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: 2024-25
Course Code: BBTP-4068
Course title: Lab in Immunology-II
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Learn about vaccines.

CO2: Study immunodiagnostic tests.

CO3: Perform immunoprecipitation reactions.

CO4: Learn protein purification methods.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4068
Course title: Lab in Immunology-II
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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

Experiments

1. Preparation of vaccine chart of child, highlighting optional vaccines
2. Haemagglutination assay
3. Haemagglutination inhibition assay
4. Double immunodiffusion test using specific antibody and antigen Line of identity, partial identity, and non-identity
5. Single immunodiffusion test using specific antibody and antigen
6. Direct and indirect ELISA
7. To perform Immunoelectrophoresis.
8. 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: 2024-25
Course Code: BBTP-4089
Course title: Lab in Biochemistry-IV
(Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Quantitatively estimate amino acids

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

CO3: Estimate nucleic acid concentration

CO4: Understand effect of mutagens on bacteria

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4089
Course title: Lab in Biochemistry-IV
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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

Experiments:

1. Quantitative estimation of amino acids using the Ninhydrin reaction.
2. Purification of protein using salt precipitation.
3. Estimation of DNA by Diphenyl reaction
4. UV induced mutagenesis

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4060
Course title: Lab in Skill Development in Biotechnology (Practical)

COURSE OUTCOMES:

After passing this course the student will be able to:

CO1: Check different food adulterants in the given products.

CO2: Determine crude fibre and protein content in food samples.

CO3: Give quality index of fats content in different food samples.

CO4: Calculate amount of energy expended by a human while at rest.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4060
Course title: Lab in Skill Development in Biotechnology
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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

Experiments:

1. 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. Determination of fat content in different food products.
5. Determine the BMR.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4061
Course title: Lab in 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: 2024-25
Course Code: BBTP-4061
Course title: Lab in Fundamentals of Bioinformatics
(Practical)

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

Practical Marks: 20

CA: 05

L-T-P: 0-0-1

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

Experiments:

1. 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: 2024-25
Course Code: BBTP-4482
Course Title: Lab in Zoology-II
(Practical)

Course outcomes

After passing this course the student will be able to:

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

CO2 Aware about the typhoid, cholera likes disease.

CO3 Understand the evolutionary phenomena.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: BBTP-4482
Couse Title: Lab in Zoology-II
(Practical)

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

Practical: 20

CA: 05

L-T-P: 0-0-1

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

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: 2024-25
Course Code: BBTF-4063
Course title: Industrial/ Institutional Visit

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

L-T-P: 0-0-1

Note:

Students will go for a visit to industry/institute and the students will be required to submit written report for the same which will be evaluated.

Bachelor of Science (Bio-Technology) Semester-IV
Session: 2024-25
Course Code: SECS- 4522
Course title: Social outreach Programme

Course Duration: 30 hours

Course Credits: 2

Course Objectives:

- The Social outreach program proposes to equip the students for community upliftment work.
- It will strive to prepare citizens who will make a marked difference in society.
- The students will be provided with numerous opportunities to build their knowledge and skills on the fundamental values of social fairness and compassion.
- The program will focus on integrating academic work with community services

Learning Outcomes:

On successful completion of this course, student will be able to

- connect the knowledge gained in the classroom with real-life situations by getting hands-on experience through community services.
- Get an opportunity to engage in social service. It will also foster the development of civic responsibility.
- Reflect upon larger issues that affect communities through readings and discussions.
- Integrate academic learning and community engagement through practical fieldwork.
- Develop awareness, knowledge, and skills for working with diverse groups in society.

MODULE	TITLE	HOURS
1.	Sensitizing the students towards Social Issues	4 Hrs.
2.	Collaborating with NGO	2 Hrs.
3.	Social Extension in villages & literacy drive	2 Hrs.
4.	NSS, Swatch Bharat, Unnat Bharat	2 Hrs.
5.	Environmental issues/NCC	2 Hrs.
6.	Empathy Corner	2 Hrs.
7.	Food Adulteration and Medical Camps	2 Hrs.
8.	Medical Camp/Adulteration Camp/Science Awareness Campaign Villages	2 Hrs.
Total Hours		18 Hrs.

Time given to students for Project Work: 12 Hrs

A. Students will be introduced to various broad areas in which they can take up projects
B. The students are expected to be actively engaged in working on any of the project areas listed below as volunteers. Evaluation will be based on consistency, commitment, and results achieved in the areas taken up.

List of Projects Are as under Social Outreach Programmes:

- Working as Motivators under the Swatch Bharat Campaign of the Government,
- Literacy drive:(I) Teaching in the Charitable School Adopted by the College
  (ii) Work on projects under taken by the Rotary Club of Jalandhar for inducting students into child labor Schools.
- Enroll as NSS Volunteers for various projects (Cleanliness, Women's health awareness)
- Counselling camps in villages
- Tree plantation (i) Maintaining the trees in the park adopted by the college. in Vikas Puri, Jalandhar
  (ii)Enrolling projects undertaken by JCI Jalandhar City

- Enrolling the Gandhian Studies Centre as a Student Volunteer for surveys in villages.
- Women Empowerment Programmes in collaboration with JCI Jalandhar Grace
- Generating awareness on voting among the youth.
- Drug Abuse (Generate awareness among the school children)
- Environment Awareness (Reduce Pollution)
- Old Age Homes/Orphanages
- Operating the Empathy Corner outside the college gate.
- Disaster Management/Relief Work

Evaluation/Assessment:

At the beginning of the semester, the students after enrolling for one of the Projects offered will be given deadlines for the project.

- Students will be responsible for recording their hours of service with the faculty and also map the progress of their subjects (children, old people, saplings, etc.).
- Therespectivedepartmentswillmonitortheinvolvementoftheirstudents.
- The students will submit a report of the project taken up by them.
- There will be no written examination, The students will be given a grade based on the evaluation of the projects by an evaluation committee, comprising of the Dean of the respective streams, the Head, and two teachers of the concerned department.

Total Marks: 25 (**Internal Assessment: 5 and Project Report: 20**) Internal

Assessment based on the attendance during the Lectures Project Report based on the

work done by the student.

Total marks: 25 converted to grade for final result

Grading system:

90% marks & above: A grade 80% -

89% marks: B grade

70%-79%marks:C grade

60%- 69%marks:D grade

50%-59% marks: E grade

Below50%marks: F grade (Fail–To repeat Project)