



Shiromani Gurudwara Parbandhak Committee's
Guru Nanak Khalsa College of Arts, Science and Commerce
(Autonomous)

Matunga, Mumbai – 400 019, Maharashtra

Program: Bachelor of Science

Syllabus

Course: FYBSc

Semester I and II

Name of Subject: Biotechnology

(As per NEP guidelines-DSC model)

With effect from Academic Year 2025 - 2026)



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)

Program Structure

Semester- I

Course Name	Teaching Hours		Credits Assigned			Marks		
	Theory	Practical	Theory	Practical	Total	Theory	Practical	Total
Major Paper Fundamentals of Biotechnology	30	60	2	2	4	50	50	100
Minor Paper Introduction to Microbiology	30	60	2	2	4	50	50	100
Open Elective I Nutritional Science-I (To opt Arts/Commerce OE)	30	--	2	-	2	50	--	50
Open Elective II (To opt Arts/Commerce OE)	30	--	2	-	2	50	--	50
Vocational Skill Course (VSC) Practical Concepts in Chemistry	--	60	--	2	2	--	50	50
Skill Enhancement Course (SEC) Microbial Techniques	--	60	--	2	2	--	50	50
Ability Enhancement Skill (AEC)	30	--	2	--	2	--	50	50
Value Education Course (VEC) Environmental Science I	30	--	2	--	2	--	50	50
Co-curricular (CC)	--	--	--	--	2	--	--	50
	180	240	12	8	22	200	300	550



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)

Program Structure

Semester- II

Course Name	Teaching Hours		Credits Assigned			Marks		
	Theor y	Practical	Theory	Practical	Total	Theory	Practical	Total
Major Paper Fundamental Genetics	30	60	2	2	4	50	50	100
Minor Paper Fundamentals of Molecular Biology and Immunology	30	60	2	2	4	50	50	100
Open Elective I Nutritional Science-II (To opt Arts/Commerce OE)	30	--	2	-	2	50	--	50
Open Elective II (To opt Arts/Commerce OE)	30	--	2	-	2	50	--	50
Vocational Skill Course (VSC) Soil and water analysis.	--	60	--	2	2	--	50	50
Skill Enhancement Course (SEC) Basics of Biochemistry and Biostatistics	--	60	--	2	2	--	50	50
Ability Enhancement Skill (AEC)	30	--	2	--	2	--	50	50
Value Education Course (VEC) Environmental Science II	30	--	2	--	2	--	50	50
Indian Knowledge System (IKS)	--	--	--	--	2	50	--	50
	180	180	12	6	22	250	300	550



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Arts

PROGRAMME OUTCOMES (PO)

BACHELOR OF SCIENCE (BSc)

Undergraduate Science Program Outcomes:

PO1	Foundational Understanding: Develop a foundational understanding of core scientific principles and theories across various disciplines of science.
PO2	Analytical Skills: Develop analytical and problem-solving skills to critically analyse scientific problems and apply scientific methodologies.
PO3	Global Perspective: Gain a global perspective by understanding diverse scientific issues and incorporating ethical considerations in scientific practices.
PO4	Research Awareness: Gain awareness of research methodologies and techniques, preparing for future research endeavours.
PO5	Holistic Development: Experience holistic development by embracing values of humanism, empathy, and social responsibility in scientific pursuits.
PO6	Communication Skills: Enhance communication skills to effectively convey scientific concepts to diverse audiences.
PO7	Continuous Learning: Develop a commitment to lifelong learning and staying updated with advancements in science.

Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Biotechnology

Programme: FYBSc Biotechnology

Programme Specific Outcomes (PSOs) for FYBSc in Biotechnology

Sr. No.	A student completing FYBSc in Biotech will be able to:
PSO 1	Develop proficiency in basic sciences alongside a comprehensive understanding of biotechnology and chemical science principles, establishing a strong foundation for advanced studies through an interdisciplinary perspective
PSO 2	Demonstrate comprehensive understanding of fundamental concepts in biotechnology, including molecular biology, microbiology, biochemistry, genetics, and cell biology, and apply this knowledge in academic, industrial, and research settings.
PSO 3	Apply knowledge of fundamental biological processes across molecular, cellular, industrial, and environmental contexts.
PSO 4	Acquire proficiency in standard laboratory techniques such as DNA/RNA isolation, gel electrophoresis, PCR, spectrophotometry, chromatography, microbial culturing, and aseptic techniques essential for biotechnological applications.
PSO 5	Analyze, interpret, and reflect on information or data to address problems in the field of biotechnology and acquire scientific and entrepreneurial skills to devise sustainable solutions to current real-world issues.
PSO 6	Integrate concepts from allied sciences including chemistry, physics, mathematics, and computer science with biotechnology to strengthen problem-solving and research capabilities.
PSO 7	Understand the principles of industrial biotechnology, bioprocess engineering, and intellectual property rights, developing skills necessary for employment in biotechnology industries, quality control laboratories, or for pursuing entrepreneurial ventures.
PSO 8	Develop effective communication skills and the ability to work both independently and in teams within the scope of scientific research writing, while demonstrating the capacity to present innovative ideas and research findings effectively.
PSO 9	Demonstrate awareness of ethical, legal, and social aspects of biotechnology research and applications, and commit to responsible and sustainable practices for the betterment of society and the environment.

SEMESTER I



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology

Semester-I: Major Paper

Course Title: Fundamentals of Biotechnology

Course Code: GNKUSBTMJ1101

Credits: 2

No of lectures (Hours): 30

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To understand the history, definition, and key fields of biotechnology and their applications across sectors.
2	Explore the use of organisms for human welfare, from traditional practices to modern biotechnological methods.
3	Analyze the scope and impact of biotechnology in India and globally.
4	Learn the basic concepts, structure, classification, and functions of key biomolecules like carbohydrates, lipids, and proteins.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Demonstrate knowledge of essential facts of the history of biotechnology and description of key scientific events in the development of biotechnology.	PO1, PO4, PO7	PSO1, PSO2	R, U

CO 2	Demonstrate knowledge of the definitions and principles of traditional and modern biotechnologies.	PO1, PO2	PSO2, PSO3	R, U
CO 3	Be able to relate to applications and benefits of Biotechnology in the various fields.	PO1, PO2, PO3, PO6	PSO2, PSO5, PSO7	U, Ap
CO 4	Evaluate the scope of Biotechnology in India, also scope in major institutes , success stories.	PO3, PO4, PO5, PO7	PSO6, PSO7, PSO9	An, E
CO 5	Classify carbohydrates, lipids, and proteins, and describe their structures, functions, and biological significance.	PO1, PO2	PSO2, PSO3	R, U, Ap
CO 6	Apply knowledge of biomolecules to analyze their roles in industrial and healthcare applications.	PO1, PO2. PO5,PO6	PSO3, PSO5, PSO7	Ap, An

Unit		FUNDAMENTALS OF BIOTECHNOLOGY	No. of lectures	CO Mapping
Unit 1		Introduction to Biotechnology	15	
	1.1	History & Introduction to Biotechnology Definition of Biotechnology, Traditional and Modern Biotechnology. Applications of Biotechnology.		CO 1, 2
	1.2	Branches of Biotechnology Plant, Animal Biotechnology, Marine Biotechnology, Agriculture, Healthcare, Industrial Biotechnology, Pharmaceutical Biotechnology, Environmental Biotechnology.		CO 3
	1.3	Biotechnology Institutions in India (Public and Private Sector), Biotech success stories, Biotech policy initiatives, Biotechnology in context of developing world, Public perception of Biotechnology. Biotechnology research in India.		CO 4

Unit 2		Biomolecules	15	
	2.1	Carbohydrates: Introduction, definition, general formula & Properties. Classification of carbohydrates, Concept of glycosidic bond, Biological significance and functions of carbohydrates.		CO 5
	2.2	Introduction to Lipid Chemistry: Definition and Biological functions of fats and Lipids. Definition of Fatty acids. Classification of Fatty acids		CO 6
	2.3	Amino acids: General introduction, Classification and structures, properties (physical & chemical), Peptide bond, Types of proteins structure.		CO 5, 6

References:

1. Dubey, R. C. (1993). A textbook of Biotechnology. S. Chand Publishing.
2. Dubey, R. C. (2014). Advanced biotechnology. S. Chand Publishing.
3. Singh, B. D., & Singh, B. D. (2007). Biotechnology expanding horizons. Kalyani publishers
4. Biochemistry by U. Satyanarayana and U. Chakrapani (3rd Edition)
5. Lehninger- Principles of Biochemistry by David Nelson and Michael Cox (4th Edition)
6. Conn, E., & Stumpf, P. (2009). Outlines of biochemistry. John Wiley & Sons

Examination:

Total Marks: 50 Marks

- **Internal Examination (20 Marks):** 8 Marks exam (MCQ and short answer question) with 20% completed syllabus. Duration of exam: 15 minutes. 7 Marks for either of Quiz/Assignments/Presentation/Viva and 5 Marks for overall performance (Class Participation, Attendance)
- **End Semester theory examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam: 1 hours
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)

Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-I: Major paper

Course Title: Practicals on Fundamentals of Biotechnology

Course Code: GNKUSBTMJ1P101

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To introduce essential biotechnology instruments and their principles and handling.
2	To develop basic laboratory skills relevant to biotechnology practices in the laboratory.
3	To teach basic qualitative biochemical tests to detect carbohydrates, amino acids, and proteins.
4	To Explain methods for determining physicochemical properties of oils and fats, such as saponification and iodine values.
5	To Encourage exploration of different biotechnology fields through research-based assignments.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Gain hands-on experience in handling essential lab instruments.	PO2, PO4, PO6	PSO4, PSO8	Ap, An

CO 2	Conduct virtual explorations of national and international research institutes to gather valuable scientific insights and current research trends.	PO4, PO7, PO3	PSO6, PSO9	U, E
CO 3	Accurately conduct analysis of biomolecules	PO1, PO2, PO4	PSO2, PSO3, PSO5	Ap, An
CO 4	Understand principle, construction and working of various laboratory instruments	PO1, PO2	PSO2, PSO4	U, Ap
CO 5	Learn titrimetric analysis of lipids such as iodine and saponification value.	PO1, PO2	PSO3, PSO4	Ap, An

List of Experiments:

- 1) Introduction to instruments used in Biotechnology
 - a. Autoclave
 - b. Hot air Oven
 - c. Centrifuge
 - d. Incubator
 - e. Rotary Shaker
 - f. Filter Assembly
 - g. LAF
 - h. pH meter
 - i. Colorimeter
- 2) Qualitative test of carbohydrates.
- 3) Qualitative test of amino acid .
- 4) Qualitative test of protein.
- 5) Detection of different carbohydrates.
- 6) Determination of saponification value of oil or fat.
- 7) Determination of Iodine value of oil.
- 8) Extraction of casein from milk.
- 9) Assignment- Study on different fields of Biotechnology

References:

1. Singh, B. D., & Singh, B. D. (2007). Biotechnology expanding horizons.Kalyani publishers
2. An Introduction to Practical Biochemistry.3rd Edition, (2001), David Plummer, Tata

McGraw Hill Edu.Pvt.Ltd. New Delhi, India

**3. Biochemical Methods S. Sadashivam, A.Manickam (1995),New age
International Publishers**

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**
- **Journal & Viva Marks: 5 + 5 Marks**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology

Semester-I: Minor Paper

Course Title: Introduction to Microbiology

Course Code: GNKUSBTMI1101

Credits: 2

No of lectures (Hours): 30

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To learn the classification, characteristics, and biological importance of bacteria, fungi, and viruses.
2	To understand the classification of microorganisms based on their metabolic types and their nutritional requirement
3	To understand principles behind culture media preparation and the techniques used for isolation and cultivation of microorganisms.
4	Gain knowledge of microbial growth patterns, growth curve phases, and methods of measuring and enumerating microbial populations.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Classify and describe the significance of bacteria, fungi, and viruses in various biological systems.	PO1, PO2	PSO2, PSO3	R,U
CO 2	Explain the general characteristics and classification of viruses and their importance in health and disease.	PO1, PO3	PSO2, PSO9	U, An

CO 3	Identify nutritional requirements and classify microorganisms based on their nutritional types (autotrophs, heterotrophs, etc.).	PO1, PO2	PSO2, PSO3	R, U, Ap
CO 4	Describe the design and use of different types of culture media and demonstrate methods for isolation and cultivation of pure cultures.	PO2, PO4, PO6	PSO4, PSO5	U, Ap
CO 5	Analyze bacterial growth phases and use direct and indirect methods for measuring microbial growth, including use of chemostat and turbidostat.	PO2, PO4	PSO3, PSO5	An, Ap

Unit		Introduction to Microbiology	No. of lectures	CO Mapping
Unit 1		Bacteria, Fungi and Viruses	15	
	1.1	Bacteria: Classification, Types, Significance of Bacteria.		CO1
	1.2	Fungi: Importance of fungi, Characteristics, Cultivation, Examples: <i>Candida</i> , <i>Saccharomyces</i> , <i>Aspergillus</i> and <i>Penicillium</i> .		CO1
	1.3	Viruses: General Characters, Classification (Plant, Animal and Bacterial Viruses) Structure and characterization of Viruses and significance.		CO2
Unit 2		Nutrition and Cultivation of Microorganisms	15	
	2.1	Nutritional Requirements: Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorus, Sulfur and Growth Factors. Classification of different nutritional types of organisms.		CO3

	2.2	Design and Types of Culture Media: Simple Medium, Differential, Selective and Enrichment Media. Concept of Isolation and Methods of Isolation. Pure Culture Techniques.		CO4
	2.3	Growth and Enumeration: Cultivation of Bacteria, Growth Phases, Growth Curve. Arithmetic Growth and Growth Yield. Measurement of Growth. Chemostat and Turbidostat. Enumeration of Microorganisms Direct and Indirect Methods.		CO5

References:

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Dr. V. K. Agarwal and Dr. P.S. Verma
2. Microbiology by Pelczar/ Chan/ Krieg- 5th Edition
3. Microbiology by Prescott, Harley and Klein
4. Fundamentals of Microbiology by Frobisher- 9th Edition
5. Fundamental Principles of Bacteriology by A. J. Salle- 7th Edition

Examination:

Total Marks: 50 Marks

- **Internal Examination (20 Marks):** 8 Marks exam (MCQ and short answer question) with 20% completed syllabus. Duration of exam: 15 minutes. 7 Marks for either of Quiz/Assignments/Presentation/Viva and 5 Marks for Overall Performance (Class Participation, Attendance)
- **End Semester theory examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam: 1 hours
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-I: Minor paper

Course Title: Practicals on Introduction to Microbiology

Course Code: GNKUSBTMI1P101

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To learn the morphology of microorganisms through wet mount.
2	To gain hands-on experience in isolation techniques and enumeration of microorganisms.
3	To learn colony characteristics to identify microorganisms
4	To analyse effect of various compounds on microorganisms
5	To learn the growth pattern of microorganisms and calculate growth rate.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Understand and identify shape and structure of microorganisms through staining	PO1, PO2	PSO2, PSO4	U,Ap
CO 2	Demonstrate proficiency in isolation, identifying microorganisms and analysing colony characteristics.	PO2, PO4, PO6	PSO4, PSO5	Ap, An

CO 3	Find out the number of microorganisms present in any given sample.	PO2, PO4	PSO3, PSO5	Ap, An
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CO 4	Evaluate effect of dyes and heavy metals on growth of microorganisms	PO2, PO3	PSO3, PSO9	An, E
CO 5	Provides valuable insights into bacterial growth dynamics, helping to understand factors influencing growth rate.	PO1, PO2	PSO2, PSO3	U, An

List of Experiments:

1. Morphological study of different types of fungi by monochrome staining.
2. Staining of fungi by wet mount method.
3. To study pure culture technique by streak plate method:
 - a. T method
 - b. Pentagonal method
 - c. 4-Quadrant method
4. Colony characteristics of microorganisms.
5. Enumeration of microorganisms by serial dilution- pour plate, spread plate method.
6. Growth curve of *E.coli*.
7. Effect of dyes by disc method.
8. Effect of heavy metals on growth of bacteria.
9. Assignment on different culture media.

References:

1. **Basic Practical Microbiology A manual, Published by the Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG, UK**
2. **Microbiology by Pelczar, Chan and Krieg- 5th Edition**
3. **Fundamentals of Microbiology by Frobisher- 9th Edition**
4. **Microbiology by Prescott, Harley and Klein- 6th Edition**
5. **Fundamental Principles of Bacteriology by A. J. Salle- 7th Edition**

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**

- **Journal & Viva Marks: 5 + 5 Marks**
- **Internal Examination (20 Marks):** Continuous Internal assessment (CIA) of 20 Marks; Any two among Quiz, Assignment, Presentation, Viva of 7 and 8 Marks and Class Participation of 5 marks.
- **Semester End Theory Examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam is 1 hour.
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology

Semester-I: Open Elective

Course Title: Nutritional Science - I

Course Code: GNKUSBTOE101

Credits: 2

No of lectures (Hours): 30

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	Understand the basic concepts of food, nutrition, and their relationship to health.
2	Learn about essential nutrients, food composition, nutrient density, and recommended dietary allowances (RDA).
3	Identify common nutritional deficiency disorders and understand preventive dietary management strategies.
4	Understand the concept of an adequate diet and the use of food guides in planning balanced meals.
5	Apply knowledge of nutrition in meal planning for different age and physiological groups such as adults, pregnant and lactating women.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Explain the functions of food and nutrients and their importance in maintaining health.	PO1, PO3	PSO2, PSO3	U
CO 2	Describe the concept and application of Recommended Dietary Allowances (RDA).	PO1, PO2	PSO2, PSO3	U,Ap

CO 3	Identify and explain the causes, symptoms, and dietary management of common nutritional disorders like PEM, iodine deficiency, iron deficiency and vitamin deficiencies.	PO1, PO2	PSO2, PSO5	R, U, Ap
CO 4	Apply food guides and nutrient density concepts to plan balanced diets and evaluate their adequacy.	PO2, PO6	PSO3, PSO5	Ap, An
CO 5	Develop meal plans for different age and physiological groups, including adults, pregnant, and lactating women, while addressing common food myths and fallacies.	PO2, PO5, PO6	PSO5, PSO8, PSO9	C, E

Unit		Nutritional Science - I	No. of lectures	CO Mapping
Unit 1		Food science and Nutrition	15	
	1.1	Food, Nutrition and Health: Functions of Food, Functions of nutrients, Food composition, Food density		CO1
	1.2	The recommended dietary allowance: Introduction, General principles of deriving RDA, Use of RDAs		CO2
	1.3	Protein-Energy Malnutrition, Prevention through dietary management, Iodine, and Iron deficiency		CO3
	1.4	Vitamin deficiency disorders.		CO3
Unit 2		Adequate diet: Food guide	15	
	2.1	Food guide for selecting an adequate diet, Nutrient density, Use of food guide in meal planning and evaluation, Fallacies about foods and nutrition		CO4

	2.2	Meal planning for various age groups: Adulthood, Pregnancy, and lactation		CO5

References:

1. **Fundamentals of Foods, Nutrition and Diet Therapy** by S. R. Mudambi and M. V. Rajagopal
2. **Nutritional science** by B. Srilakshmi
3. **Nutritive value of indian foods** by C. Gopalan
4. **Food science** by S. Mudambi, S. Rao and M.V. Rajgopal

Examination:

- **Internal Examination (20 Marks):** Continuous Internal assessment (CIA) of 20 Marks; Any two among Quiz, Assignment, Presentation, Viva of 7 and 8 Marks and Class Participation of 5 marks.
- **Semester End Theory Examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam is 1 hour.
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology
Semester-I: Value Education Course (VEC)
Course Title: -Environmental Science I
Course Code: GNKUSBTVEC101
Credits: 2
No of lectures (Hours): 30
Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	Understand the structure and function of ecosystems, including energy flow, trophic levels, and ecological succession.
2	Learn the principles of sustainable development and analyze key biogeochemical cycles essential for ecosystem balance.
3	Identify and explain various ecological interactions and the role of biotic and abiotic components in ecosystem dynamics.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Define and describe the structure and function of ecosystems, including biotic and abiotic components.	PO1, PO2	PSO2, PSO3	R, U
CO 2	Explain energy flow through trophic levels, food chains, food webs, and ecological pyramids.	PO1, PO2, PO3	PSO2, PSO3	U, Ap

CO 3	Understand the concept of ecological niches and natural succession in ecosystems.	PO1, PO2, PO3	PSO2, PSO3	U, An
CO 4	Apply principles of sustainable development to evaluate environmental practices and policies.	PO2, PO3, PO5, PO7	PSO5, PSO9	Ap, E

CO 5	Describe major biogeochemical cycles and ecological interactions and their roles in maintaining ecosystem balance.	PO1, PO2, PO3	PSO2, PSO3	U, Ap
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Unit		ENVIRONMENTAL SCIENCE - I	No. of lectures	CO Mapping
Unit 1		Ecosystem and Sustainable development	15	
	1.1	Ecology and Biogeography, Ecosystems, Definition and Components, Structure and Function of Ecosystems.		CO 1
	1.2	Biotic and Abiotic Factors, Trophic Levels, Food Chain and Food Web, Ecological Pyramids (Energy, Biomass and Number) Niche, Succession.		CO 2, 3
	1.3	Concept, need, Principles and guidelines and components of sustainable development		CO 4
Unit 2		Biogeochemical cycles	15	
	2.1	Types of biogeochemical cycles : Water, Oxygen, Carbon, Nitrogen, sulfur, phosphorus.		CO 5
	2.2	Biogeochemical cycle of micronutrients.		CO 5
	2.3	Interactions: Commensalism, Mutualism, Predation and Antibiosis, Parasitism.		CO 5

References:

1. Textbook of Plant Physiology by V. Verma
2. Pradeep's – A Textbook of Biology by P. S. Dhami and H. N. Srivastava
3. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Dr. V. K. Agarwal and Dr. P.S. Verma
4. Foundation course II by Manan Prakashan

Examination:

- **Internal Examination (20 Marks):** Continuous Internal assessment (CIA) of 20 Marks; Any two among Quiz, Assignment, Presentation, Viva of 7 and 8 Marks and Class Participation of 5 marks.
- **Semester End Theory Examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam is 1 hour.
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-I: Vocational Skill Course (VSC)

Course Title: Practical Concepts in Chemistry

Course Code: GNKUSBTVSC101

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To learn basic fundamental practices in laboratories /GLP
2	To understand principle and working of colorimeter
3	Provide the practical basis for electronic balance and pH meter handling and operations.
4	To acquaint the students with basic concepts of Chemistry like preparation of solutions and buffers.
5	To gain knowledge of Titrimetric and Volumetric estimation.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Know the basic knowledge about safety to follow in laboratory	PO1, PO5	PSO4, PSO9	R, U
CO 2	Find concentration of unknown sample using colorimeter	PO2, PO4	PSO4, PSO5	Ap, An

CO 3	Understand and handle electronic balance and pH meter	PO2, PO4	PSO4	U, Ap
CO 4	Calculate and prepare various buffers and molar solutions	PO1, PO2	PSO4, PSO6	Ap
CO 5	Develop skills towards the use of titrimetric analysis	PO2, PO4	PSO4, PSO5	Ap, C

List of Experiments:

1. Safety measures and practices in the laboratory.
2. Working and use of a digital balance.
3. Working and functioning of pH meter.
4. Standardization of pH meter.
5. Preparation of solutions (moles/ Molar/ Normality/ Molality etc)
6. Determination of acetic acid in vinegar by titrimetric Method.
7. Study of buffers:
 - i. Concept of buffer
 - ii. Types of buffers
 - iii. Derivation of Henderson equation for acidic and basic buffers.
8. Preparation of standard buffers
9. Study on types of titrations: Acid-Base, Redox; Precipitation; Complexometric titration; Strong Acid Vs Strong Base.
10. Dissociation constant of weak acids by incomplete titration method using pH meter and determination of acetic acid in vinegar by titrimetric method.

References:

1. **Fundamentals of Analytical Chemistry(2022)10th edition -Douglas Skoog, Donald West, Cengage Technology Edition**
2. **College Physical and Analytical Chemistry,(2014)K.B.Baliga, S.A.Zaveri,Himalaya Publishing House**
3. **Chemical Calculations by R.C. Mukherjee**
4. **Biophysical Chemistry: Principles and Techniques by Upadhyay and Upadhyay**
5. **Principles and Techniques of Biochemistry and Molecular Biology by Keith Wilson and John Walker- 7th Edition**

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**
- **Journal & Viva Marks: 5 + 5 Marks**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-I: Skill Enhancement Course (SEC)

Course Title: Microbial Techniques

Course Code: GNKUSBTSEC101

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To develop a skill to handle and care for microscopes.
2	To evolve crucial skills in microbial techniques and set down the groundwork for more advanced studies in microbiology.
3	To acquaint students with basic staining methods for identifying microorganisms.
4	To understand the sterilization process and its importance.
5	To get knowledge of microbial nutrition

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Operate a compound microscope, prepare and observe biological samples/microorganisms	PO2, PO4	PSO2, PSO4	Ap

CO 2	Apply skills in microbial techniques for more advanced studies in microbiology	PO2, PO4, PO7	PSO2, PSO3, PSO5	Ap, C
CO 3	Choose type of staining technique, mounting method to observe specific microorganism	PO2,PO3	PSO2 PSO4	An, Ap
CO 4	Understand the significance and methods of sterilization	PO1, PO2	PSO2, PSO4	U
CO 5	Grow microorganisms in a suitable growth media.	PO2, PO4	PSO2, PSO3, PSO4	Ap

List of Experiments:

1. Components and working of a compound microscope.
2. Monochrome staining of microorganisms
3. Special staining technique for cell wall, endospore, metachromatic granule.
4. Study of Gram nature of different bacteria by Gram staining.
5. Aseptic transfer techniques.
6. Principle, construction and working of an autoclave.
7. Sterilization of glasswares.
8. Preparation of media- Nutrient broth and Agar, MacConkey Agar, Sabouraud's Agar.
9. Preparation of slant, butts and plates.
10. Study of the effect of pH, temperature and osmotic pressure on the growth of bacteria.
11. Preservation of bacteria- oil overlay, subculture, low temperature.
12. Study of microbial enzymes:
 - I. Amylase,
 - II. Lipase
 - III. Protease
 - IV. Urease
 - V. Catalase
 - VI. Dehydrogenase

References:

- 1. Basic Practical Microbiology A manual, Published by the Society for General Microbiology, Marlborough House, Basingstoke Road, Spencers Wood, Reading RG7 1AG, UK**
- 2. Microbiology by Pelczar, Chan and Krieg- 5th Edition**
- 3. Microbiology by Pelczar, Chan and Krieg- 5th Edition**
- 4. Fundamentals of Microbiology by Frobisher- 9th Edition**
- 5. Microbiology by Prescott, Harley and Klein- 6th Edition**
- 6. Fundamental Principles of Bacteriology by A. J. Salle- 7th Edition**
- 7. Ochei J and Kolhatkar (2000); Medical Laboratory Science, Theory and Practice, Tata McGraw-Hill Publishing Company**

Total Marks: 50 Marks

● Experiment Marks: 40 Marks ●

Journal & Viva Marks: 5 + 5 Marks

SEM II



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology
Semester-II: Major Paper
Course Title: Fundamental Genetics
Course Code: GNKUSBTMJ1102
Credits: 2
No of lectures (Hours): 30
Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To acquaint students with concepts in Genetics.
2	Understand the structure and function of DNA and RNA, along with chromosomal organization
3	Develop an understanding of structure and organization of the hereditary material
4	Explore deviations from Mendelian genetic principles, environmental influences on gene expression

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Understand the fundamentals of genetics.	PO1, PO2	PSO2, PSO3	R, U
CO 2	Understand that these nucleic acids are building blocks of genetic information.	PO1, PO4	PSO2, PSO3	R, U

CO 3	Understand heredity and predict inheritance patterns that are the basis of genetic counseling.	PO2, PO3	PSO2, PSO5	U, Ap
CO 4	Analyze genetic deviations, understand environmental impacts on gene expression.	PO2, PO5	PSO2, PSO5	An, E
CO4				
CO5				

CO 5 Be well versed with the knowledge of bacteriophages PO1, PO4 PSO2, PSO6
 concept of conjugation, which are viruses that infect U, Ap R, U
transformation, transduction and replicate within bacteria.
and transposition. **CO 6** Gain PO1, PO2 PSO2, PSO4

Unit		Fundamental Genetics	No. of lectures	CO Mapping
Unit 1		Nucleic acid and Extension of Mendelian Genetics	15	
	1.1	Nucleotide and nucleoside, Structure of nucleotides, Structure of DNA, DNA double helix, Watson and Crick's model, Structure of RNA, Types of RNA.		CO 1 , 2
	1.2	Prokaryotic and Eukaryotic Chromosome, Euchromatin and Heterochromatin.		CO 2
	1.3	Extensions of Mendelian Genetics: Codominance, Incomplete dominance, Gene interactions, Epistasis, Penetrance and expressivity, Lethal genes and Essential genes, Environmental effect on the expression of genes (4 factors).		CO 3, 4
Unit 2		Microbial genetics	15	
	2.1	Genetic analysis in Bacteria: Prototroph, Auxotroph		CO 5

	2.2	Bacteriophages: Lytic and Lysogenic development of phage.		CO 6
	2.3	Mechanism of genetic exchange in Bacteria: Conjugation; Transformation; Transduction (Generalized Transduction, Specialized Transduction).		CO 5

References:

1. iGenetics – A molecular approach Peter J Russell 2nd edition
2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Dr. V. K. Agarwal and Dr. P.S. Verma
3. Principles of Genetics. E J Gardner, M J Simmons & D PeterSnustad. 8th edition. 1991.
4. Biochemistry - U Satyanarayana U. Chakrapani, (2013) 4th edition.
5. Fundamentals of Genetics- B. D. Singh, KALYANI PUBLISHER

Examination:

Total Marks: 50 Marks

- **Internal Examination (20 Marks):** 8 Marks exam (MCQ and short answer question) with 20% completed syllabus. Duration of exam: 15 minutes. 7 Marks for either of Quiz/Assignments/Presentation/Viva and 5 Marks for Overall Performance (Class Participation, Attendance)
- **End Semester theory examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam: 1 hours
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)

Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-II: Major Paper

Course Title: Practicals on Fundamental Genetics

Course Code: GNKUSBTMJ1P102

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To extract genomic DNA from plant material.
2	To gain basis and hands on of electrophoresis technique
3	To learn fundamental principles of how traits are inherited
4	To gain hands on replica plate technique

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Evolve skill in DNA extraction.	PO4, PO6	PSO4, PSO6	Ap, C
CO 2	Analyse DNA molecules through electrophoresis.	PO2, PO4	PSO4, PSO6	Ap, An
CO 3	Solve mendelian genetics problems.	PO2, PO3	PSO2, PSO5	U, Ap
CO 4	Develop skills in replica plate technique.	PO2, PO5	PSO4, PSO7	Ap, C

List of Experiments:

1. Extraction and isolation of genomic DNA from plants.
2. Separation and visualisation of DNA by Agarose gel electrophoresis.
3. Purification of DNA.
4. Effect of UV light on microorganisms.
5. Problems on extension of Mendelian Genetics.
6. Replica plate technique.
7. Qualitative test for DNA by DPA.
8. Qualitative test for RNA by orcinol.
9. Assignment on Microbial genetics.

References:

1. **Biotechnology Laboratory Manual by R.S. Gaud and A.D. Deshpande (Jaico Publishing House, 2010)**
2. **Practical Biotechnology: Techniques and Experiments by S.K. Singh (Rastogi Publications, 2013)**

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**
- **Journal & Viva Marks: 5 + 5 Marks**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology

Semester-II: Minor Paper

Course Title: Fundamentals of Molecular Biology and Immunology

Course Code: GNKUSBTMI1102

Credits: 2

No of lectures (Hours): 30

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To build a firm foundation of molecular biology
2	To gain knowledge of DNA replication processes
3	To understand the concepts of immunology
4	To learn various mechanisms of development of immunity

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Understand the fundamentals of cell division and how genetic information is passed down.	PO1, PO2	PSO2, PSO3	R, U
CO 2	Discuss the different processes involved in replication of DNA.	PO1, PO4	PSO2, PSO4	U, Ap
CO 3	Give an overview of the Immune system and how it functions.	PO1, PO3	PSO2, PSO5	R, U
CO 4	Explain the various types of immune mechanisms.	PO2, PO5	PSO2, PSO6	U, An

Unit		Fundamentals of Molecular Biology and Immunology	No. of lectures	CO Mapping
Unit 1		Replication	15	
	1.1	DNA Replication in Prokaryotes: Semi-conservative DNA replication, DNA Polymerases and its role, <i>E. coli</i> Chromosome Replication, Bidirectional Replication of Circular DNA molecules. Rolling Circle Replication		CO 2
	1.2	DNA Replication in Eukaryotes		CO 2
	1.3	DNA Recombination: Holliday Model for Recombination Transformation		CO 1
Unit 2		Immunology	15	
	2.1	Innate Immunity, Acquired Immunity, Local and Herd Immunity		CO 3
	2.2	Humoral and Cellular Immunity - Factors influencing and mechanisms of each.		CO 4
	2.3	Antigen: Types of Antigens, General Properties of Antigens, Haptens and Superantigens.		CO 4
	2.4	Antibodies: Discovery and Structure of Antibodies (Framework region) Classes of Immunoglobulins, Antigenic Determinants.		CO 4

References:

1. iGenetics by Peter J. Russell- 2nd Edition
2. Biotechnology- Fundamentals and Applications by S. S. Purohit- 3rd Edition
3. The Elements of Immunology by Fahim Halim Khan
4. Immunology- 5th Edition by Janis Kuby

Examination:

Total Marks: 50 Marks

- **Internal Examination (20 Marks):** 8 Marks exam (MCQ and short answer question) with 20% completed syllabus. Duration of exam: 15 minutes. 7 Marks for either of Quiz/Assignments/Presentation/Viva and 5 Marks for Overall Performance (Class Participation, Attendance)
- **End Semester theory examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam: 1 hours
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-II: Minor Paper

Course Title: Practicals on Fundamentals of Molecular Biology and Immunology

Course Code: GNKUSBTMI1P102

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To Understand fundamental cellular processes such as mitosis, meiosis,
2	To learn basic principle and method of blood group determination test
3	To learn blood cell counting through haemocytometer
4	Preparation of blood smear and staining

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Demonstrate the steps of mitosis and meiosis.	PO1, PO2, PO4	PSO2, PSO4	U, Ap
CO 2	Determine blood type and Rh factor.	PO2, PO4, PO6	PSO4, PSO5	Ap, An
CO 3	Analyse the RBC and WBC count.	PO2, PO4, PO5	PSO4, PSO5	An, E

CO 4	Differentiate blood cells for microscopic examination.	PO2, PO4, PO6	PSO2, PSO4	Ap, An
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List of Experiments:

1. Study of mitosis from suitable plant material.
2. Study of meiosis from suitable plant material/Permanent slides/Photographs.
3. Study of human blood groups.
4. Determination of RBC and WBC count using hemocytometer.
5. Differential staining of WBCs using Romanowsky Stains: Field's staining.
6. Estimation of Haemoglobin by Sahli's method.
7. Separation of lymphocytes by density gradient centrifugation.
8. Project/Model making on Replication.

References:

1. Molecular Biology of the Cell. 5th ed. by Alberts,
2. <http://www.marietta.edu/%7Ebiol/introlab/Onion%20root%20mitosis.pdf>
3. <http://staff.jccc.net/pdecell/celldivision/oniontip.html>
4. <http://www.ruf.rice.edu/%7Ebioslabs/methods/microscopy/cellcounting.html>
5. http://www.teachertube.com/viewVideo.php?album_id=&title=ABO_Blood_Types&video_id=115694&vpkey=
6. Immunology by Roit

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**
- **Journal & Viva Marks: 5 + 5 Marks**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology

Semester-II: Open Elective

Course Title: NUTRITIONAL SCIENCE - II

Course Code: GNKUSBTOE102

Credits: 2

No of lectures (Hours): 30

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To understand the basic terminology like calorific value of food, BMR and RQ
2	To learn measure of BMR
3	To impart the concept of modifying normal diets to therapeutic diets
4	Understand role therapeutic diet for certain lifestyle disorders

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Determine the caloric value of different food and its components.	PO1, PO2	PSO2, PSO5	Ap, An
CO 2	Role of BMR in weight management.	PO1, PO3, PO5	PSO2, PSO6	U,An
CO 3	Plan a diet for certain disorders.	PO2, PO4, PO5	PSO3, PSO5	Ap, E
CO 4	Focus on the preventive role of nutrition in the current lifestyle situations.	PO3, PO5, PO7	PSO5, PSO9	U, E

Unit		NUTRITIONAL SCIENCE - II	No. of lectures	CO Mapping
Unit 1		Energy Metabolism	15	
	1.1	Energy value: Methods of measurement of energy, value of nutrients- direct and indirect		CO 1
	1.2	Basal metabolic rate-measurement and factors affecting BMR, RQ value (Numerical expected)		CO 2
Unit 2		Diet Therapy	15	
	2.1	Introduction to diet therapy, Planning of therapeutic diets, Types of diets		CO 3
	2.2	Nutrition in Diabetes mellitus and cardiovascular diseases		CO 3, 4

References:

1. Fundamentals of Foods, Nutrition and Diet Therapy by S. R. Mudambi and M. V. Rajagopal
2. Nutritional science by B. Srilakshmi
3. Nutritive value of indian foods by C. Gopalan
4. Food science by S. Mudambi, S. Rao and M.V. Rajgopal

Examination:

- **Internal Examination (20 Marks):** Continuous Internal assessment (CIA) of 20 Marks; Any two among Quiz, Assignment, Presentation, Viva of 7 and 8 Marks and Class Participation of 5 marks.
- **Semester End Theory Examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam is 1 hour.
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: F.Y.B.Sc. Biotechnology
Semester-II: Value Education Course (VEC)
Course Title: Environmental Science - II
Course Code: GNKUSBTVEC102
Credits: 2
No of lectures (Hours): 30
Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To understand the origin, types, and sources of pollution and pollutants.
2	To study various forms of pollution including air, water, land, radioactive, noise, plastic, and light pollution.
3	To learn about the conservation and sustainable management of natural resources such as minerals, energy, food, forests, wildlife, water, and land.
4	To explore the causes and impacts of soil erosion and measures for its prevention.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Identify and analyze various types of pollution, their sources, and their impact on the environment and human health.	PO1, PO2, PO3, PO5	PSO2, PSO5, PSO9	R, U, An
CO 2	Classify natural resources and explain their ecological roles and importance.	PO1, PO2	PSO2, PSO3	R, U
CO 3	Demonstrate knowledge of conservation and sustainable management of minerals, energy, food, forests, water, and wildlife.	PO3, PO5, PO7	PSO5, PSO9	U, Ap, E

CO 4	Evaluate sustainable practices in agriculture, aquaculture, and land use, including strategies to prevent soil erosion and land degradation.	PO2, PO5, PO7	PSO5, PSO9	An, E
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Unit		Environmental Science - II	No. of lectures	CO Mapping
Unit 1		Pollution	15	CO1, CO2
	1.1	Origin of pollution, Pollutants, types of pollutants, Air pollution, Water pollution,		CO1
	1.2	Land pollution, Radioactive pollution, Noise pollution, Plastic pollution, Light pollution		CO2
Unit 2		Natural resource ecology	15	CO2, CO3, CO4
	2.1	Classification of natural resources, conservation and management : Mineral, energy , Food Agriculture and Aquaculture, Forest		CO2, CO3
	2.2	Wild life, Water, Land, soil erosion.		CO2, CO3, CO4

References:

1. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Dr.

V. K. Agarwal and Dr. P.S. Verma

2. Environmental biotechnology by Indu Shekhar Thakur

Examination:

- **Internal Examination (20 Marks):** Continuous Internal assessment (CIA) of 20 Marks; Any two among Quiz, Assignment, Presentation, Viva of 7 and 8 Marks and Class Participation

of 5 marks.

- **Semester End Theory Examination (30 Marks):** Weightage of each unit will be proportional to the number of lecture hours as mentioned in the syllabus. Duration of exam is 1 hour.
- **Combined passing of 40% with minimum 20% in Internal Component.**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical
Semester-II: Vocational Skill Course (VSC)
Course Title: Soil and water analysis.
Course Code: GNKUSBTVSC102
Credits: 02
No of Practical (Hours): 60
Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To provide practical knowledge of soil physical and chemical properties through standard analytical methods.
2	To train students in determining key soil parameters including pH, moisture, nutrients, and salinity.
3	To develop skills in analyzing water quality indicators such as pH, electrical conductivity, alkalinity, acidity, hardness, and salinity.
4	To enhance students' ability to assess environmental samples for agricultural and ecological applications.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Explain the impact of environmental pollution on agriculture, ecosystems, and natural resources.	PO1, PO3, PO5	PSO2, PSO5, PSO9	U, An

CO 2	Analyze physical and chemical properties of soil and water, and understand their role in agricultural productivity.	PO2, PO4	PSO3, PSO5	An, U
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CO 3	Apply appropriate treatment methods to enhance soil and water quality for sustainable use.	PO2, PO5, PO7	PSO5, PSO9	Ap, E
CO 4	Evaluate land and water management practices and demonstrate environmental responsibility through sustainable actions.	PO3, PO5, PO7	PSO5, PSO9	E, C

List of Experiments:

1. Determination of color, texture of soil
2. Determination of pH of soil sample.- using a universal indicator.
3. Determination of moisture content of soil sample.
4. Determination of available Phosphate from soil sample.
5. Determination of Calcium from soil sample.
6. Determination of Organic Carbon from soil sample.
7. Determination of pH and electrical conductivity of water sample.
8. Determination of total Alkalinity of water sample.
9. Determination of Acidity of water sample.
10. Determination of total hardness water sample.
11. Determination of salinity of the water sample.

References:

1. **Manual and Standard Methods for the Examination of Water and Wastewater**
APHA (The American Public Health Association).
2. **Manual on soil, plant and water analysis-** Dhyan Singh, P.K. Chhonkar and B.S. Dwivedi. Westville publishing house, New Delhi.

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**
- **Journal & Viva Marks: 5 + 5 Marks**



Guru Nanak Khalsa College of Arts, Science and Commerce (Autonomous)
Department of Department of Biotechnology

Course: FY B.Sc. Biotechnology Practical

Semester-II: Skill Enhancement Course (SEC)

Course Title: Basics of Biochemistry and Biostatistics

Course Code: GNKUSBTSEC102

Credits: 02

No of Practical (Hours): 60

Marks: 50

Course Objectives:

Sr. No.	Course objectives
The course aims at:	
1	To learn basic understanding of the several concepts associated with practical Biochemistry
2	To introduce learners to the principles, applications and skills of using colorimeter
3	To learn quantitative estimation of biomolecules
4	To learn basic chromatographic techniques.
5	To understand the concept of centrifugation.

Course Outcomes (COs):

Sr. No.	On completing the course, the student will be able to:	POs addressed	PSOs addressed	Cognitive Levels addressed
CO 1	Handle and use colorimeter	PO1, PO4	PSO1	U, Ap
CO 2	Demonstrate an understanding of Beer-Lambert's law and its applications	PO1, PO2	PSO1	U, Ap

CO 3	Analyse carbohydrates and proteins from samples.	PO1, PO3, PO4	PSO2	An
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CO 4	Separate the various substance from mixture by paper and column chromatography	PO1, PO3, PO5	PSO2	Ap, An
CO 5	Separate component by centrifugation for future analysis.	PO1, PO4, PO5	PSO2	Ap

List of Experiments:

1. Demonstration of verification of Beer Lambert's Law.
2. Quantitative estimation of Protein by Biuret method.
3. Quantitative estimation of carbohydrates by the DNSA method.
4. Separation of Amino acids by paper chromatography.
5. Separation of Chlorophyll by column chromatography.
6. Separation of plant pigment by density gradient centrifugation.
7. Types of data, Normal and frequency distribution.
8. Representation of Data and Graphs using Bar diagrams, Pie charts and Histogram, Polygon and Curve.
9. Types of Population Sampling.
10. Measures of Central Tendency.
11. Partition values- Quartiles, Deciles and Percentiles

References:

1. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology (2018) 8th edition
2. Laboratory Manual in Biochemistry (2004) 2nd edition. Jayaraman, J. New Age International (P) Limited Publishers
3. Introduction to Practical Biochemistry. (2001) 3rd edition. Plummer, D. T., Tata McGraw Hill Publishing Company.
4. Research Methodology by C.R.KOTHARI.
5. Biostatistics by P.N.Arora and P.K. Malhan.

Total Marks: 50 Marks

- **Experiment Marks: 40 Marks**
- **Journal & Viva Marks: 5 + 5 Marks**