Government Science College, Vankal

Department of Zoology

Short Term Course

Course Code: STCZO02 **Course Name:** Ornithology **Duration:** 30 h

INTRODUCTION

Ornithology, the study of birds, offers insight into the behavior, ecology, and conservation of avian species. This course aims to provide a comprehensive understanding of bird biology, their ecological roles, and the methods used in ornithological research.

OBJECTIVES

- To introduce students to the basic principles of ornithology.
- To understand the anatomy, physiology, and behavior of birds.
- To explore bird ecology and conservation strategies.
- To familiarize students with field techniques and research methods in ornithology.
- To promote awareness of the importance of birds in ecosystems and biodiversity.

MODULES

Module 1: Introduction to Ornithology (5 Hours)

- History and scope of ornithology
- Evolution and classification of birds
- Overview of bird diversity

Module 2: Anatomy and Physiology of Birds (5 Hours)

- Morphological adaptations
- Flight mechanics
- Respiratory and circulatory systems
- Reproductive biology

Module 3: Bird Behavior (5 Hours)

- Communication and vocalizations

- Migration and navigation
- Breeding and nesting behaviors
- Feeding strategies

Module 4: Bird Ecology (5 Hours)

- Habitat requirements and preferences
- Role of birds in ecosystems
- Bird-plant interactions
- Predator-prey dynamics

Module 5: Bird Conservation (5 Hours)

- Threats to bird populations
- Conservation strategies and practices
- Role of protected areas and legislation
- Case studies of successful bird conservation programs

Module 6: Ornithological Research Methods (5 Hours)

- Field observation techniques
- Bird banding and tracking
- Use of technology in ornithology (e.g., GPS, drones)
- Data collection and analysis

OUTCOMES

- Understand the fundamental concepts of ornithology.
- Recognize the anatomical and physiological adaptations of birds.
- Comprehend bird behaviors and their ecological significance.
- Identify major threats to bird populations and conservation strategies.
- Apply basic research techniques used in ornithology.

REFERENCES

- Gill, F.B. (2007). *Ornithology*. W.H. Freeman and Company.
- Proctor, N.S., & Lynch, P.J. (1998). *Manual of Ornithology: Avian Structure and Function*. Yale University Press.

- Sibley, D.A. (2003). *The Sibley Field Guide to Birds*. Knopf.
- Newton, I. (1998). *Population Limitation in Birds*. Academic Press.
- BirdLife International (www.birdlife.org)

EVALUATION

- **Quizzes (30%)**: Short quizzes at the end of each module to assess understanding.
- **Assignments (30%)**: Written assignments on specific topics such as bird behavior, conservation strategies, or research methods.
- **Field Project (40%)**: A mini research project involving field observation, data collection, and analysis.

ISSUE OF MARKSHEET AND CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of course coordinator at the end of programme.

1. After successful completion of the course, no marks will be given to students only grades will be given as per follows

Percentage Range of Marks (Theory + Projects)	**Remarks**
90-100	O
80-90	A
60-80	B
40-60	C
<40	F

COURSE COORDINATOR:

Dr. Rajesh Senma,
HoD, Zoology Department,
GSC Vankal.

Department of Botany |
Government Science College, Vankal
Ta. Mangrol, Dist. Surat
AISHE Code: C- 46595

==========

Short Term Course

Basic Molecular Biology

Course code: STCBO02

Course title: Basic Molecular Biology

Course Duration: 30 Hours

Course Introduction

This short-term course provides a foundational understanding of molecular biology, focusing on the key concepts, techniques, and applications. Designed for beginners, it covers the structure and function of macromolecules, gene expression and regulation, and basic laboratory techniques.

Course Objectives

By the end of this course, participants will:

1) Understand the basic concepts of molecular biology.
2) Learn about the structure and function of DNA, RNA, and proteins.
3) Comprehend the processes of DNA replication, transcription, and translation.
4) Familiarize with molecular biology techniques such as PCR, gel electrophoresis, and cloning.
5) Explore applications of molecular biology in research and industry.

Module Outline and Outcomes

Module 1: Introduction to Molecular Biology (5 hours)

Topics Covered:

- Overview of molecular biology
- Historical milestones
- Central Dogma of molecular biology

Outcome:

Students will be able to describe the scope and significance of molecular biology and its historical context.

==========

Module 2: Structure and Function of Macromolecules (7 hours)

Topics Covered:

- Structure of DNA and RNA
- DNA replication
- Structure and function of proteins

Outcome:

Students will understand the molecular structure of DNA, RNA, and proteins and their roles in the cell.

Module 3: Gene Expression and Regulation (8 hours)

Topics Covered:

- Transcription and RNA processing
- Translation and protein synthesis
- Regulation of gene expression

Outcome:

Students will comprehend how genes are expressed and regulated in cells.

Module 4: Molecular Biology Techniques (7 hours)

Topics Covered:

- Polymerase Chain Reaction (PCR)
- Gel electrophoresis
- DNA cloning and sequencing

Outcome:

Students will gain practical knowledge of fundamental molecular biology techniques and their applications.

Module 5: Applications of Molecular Biology (3 hours)

Topics Covered:

- Molecular biology in medicine
- Biotechnology and genetic engineering
- Future trends and ethical considerations

Outcome:

Students will explore the practical applications of molecular biology in various fields and understand the ethical implications.

Evaluation:

- Quizzes (30%) - Quizzes at the end of each module to assess understanding of key concepts.
- Practical Assignments (40%) - Hands-on assignments involving molecular biology techniques.
- Final Exam (30%) - A comprehensive test covering all course content.
- Participation (Bonus) - Active participation in discussions and activities.

Recommended Reading

"Molecular Biology of the Cell" by Alberts et al.

"Molecular Biology" by Robert F. Weaver

"Essential Molecular Biology: A Practical Approach" by Brown &Hewick

This course is designed to provide a thorough introduction to molecular biology, equipping participants with the knowledge and skills necessary for further study or entry-level work in the field.

Issue of Marksheet and Certificate

The college shall publish the result after evaluation and with the recommendations of course coordinator at the end of programme.

1. After successful completion of the course, no marks will be given to students only grades will be given as per follows

Percentage Range of Marks (Theory + Practical)	Remarks
90-100	O
80-90	A
60-80	B
40-60	C
<40	F

Course Co-ordinator:

Dr.Meghna Adhvaryu,

HoD, Department of Botany,

GSC Vankal

Government Science College, Vankal

Department of Microbiology

Short Term Course

Course Code: STCMB03 **Course Name:** Biochemical and microbiological analysis of milk **Duration:** 30 h

Introduction

Milk is a highly nutritious and versatile food, but it is also a complex biological fluid that requires rigorous testing to ensure its safety and quality. This course is designed to provide students and professionals with the essential knowledge and practical skills needed to perform chemical and microbiological analyses of milk.

Objectives

- Understand the composition and properties of milk.
- Learn the principles and methods for chemical analysis of milk.
- Gain knowledge about microbiological testing and safety standards for milk.
- Develop practical skills in performing both chemical and microbiological analyses.
- Interpret and report results accurately to ensure milk quality and safety.

Modules

Module 1: Introduction to Milk Composition and Properties 5 h

- Composition of milk (proteins, fats, carbohydrates, vitamins, minerals)
- Physical properties of milk (density, viscosity, pH)
- Factors affecting milk composition and quality

Module 2: Chemical Analysis of Milk 5 h

- Determination of fat content (Gerber method, Babcock method)
- Measurement of protein content (Kjeldahl method)
- Detection of adulterants and contaminants

Module 3: Microbiological Analysis of Milk 5 h

- Introduction to milk microbiology
- Common microbial contaminants in milk

- Standard plate count (SPC) method
- Coliform count and E. coli testing

Module 4: Milk Quality and Safety Standards 5 h

- National and international milk quality standards (e.g., FDA, EU regulations)
- Good manufacturing practices (GMP) in dairy production
- Hazard Analysis Critical Control Point (HACCP) system in dairy industry

Module 5: Practical Sessions 10 h

- Hands-on lab sessions for chemical analysis techniques
- Practical exercises in microbiological testing methods

Course Outcomes

By the end of the course, participants will:

- Have a thorough understanding of the composition and properties of milk.
- Be proficient in conducting various chemical analyses to determine milk quality.
- Be skilled in performing microbiological tests to detect and quantify microbial contaminants in milk.
- Understand and apply milk quality and safety standards in their work.
- Be capable of analyzing, interpreting, and reporting the results of milk tests accurately.

Evaluation Norms

- **Quizzes**: Short quizzes at the end of each module to assess theoretical understanding (60% of the final grade).
- **Lab Reports**: Detailed reports on the practical sessions, including data analysis and interpretation (40% of the final grade).

ISSUE OF MARKSHEET AND CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of course coordinator at the end of programme. After successful completion of the course, no marks will be given to students only grades will be given as per follows

Percentage Range of Marks (Theory + Practical)	Remarks
90-100	O
80-90	A
60-80	B
40-60	C
<40	F

COURSE COORDINATOR:

Dr.Nishant Junnarkar,
HoD, Microbiology Department,
GSC Vankal.

Government Science College, Vankal

Department of Chemistry

Short Term Course

Course Code: STCMB03 **Course Name:** Introduction to Name Reactions in Organic Chemistry **Duration:** 30 h

Introduction to Name Reactions in Organic Chemistry

INTRODUCTION

Name reactions are pivotal in organic chemistry, serving as fundamental tools for synthesizing a wide range of compounds. These reactions are named after their discoverers or based on their characteristic transformations. This short-term course aims to familiarize participants with key name reactions, their mechanisms, applications, and synthetic utility. Participants will gain an in-depth understanding of these reactions and their significance in both academic and industrial chemistry.

OBJECTIVES

- Understand the mechanisms and applications of various name reactions.
- Apply name reactions to design and synthesize organic compounds.
- Analyse reaction conditions and predict outcomes based on reaction types.
- Utilize name reactions in solving complex synthetic challenges.
- Develop skills in reviewing and presenting reaction mechanisms and applications.

COURSE MODULES

Module 1: Introduction to Name Reactions

- Definition and significance of name reactions
- Historical context and development
- Overview of common categories of name reactions

Module 2: The SN_1 and SN_2 Reactions

- Mechanisms and factors affecting reaction pathways
- Examples: S_N1 (e.g., hydrolysis of tert-butyl chloride), S_N2 (e.g., alkyl halide substitution)

- Applications and limitations

Module 3: The E_1 and E_2 Reactions

- Mechanisms of E1 and E2 eliminations
- Examples: Dehydration of alcohols, dehydrohalogenation
- Applications in organic synthesis

Module 4: The Friedel-Crafts Reactions

- Friedel-Crafts Alkylation and Acylation mechanisms
- Examples: Benzene alkylation, acylation
- Applications and challenges

Module 5: The Grignard Reaction

- Mechanism and preparation of Grignard reagents
- Examples: Addition of Grignard reagents to carbonyl compounds
- Applications in synthesis and limitations

Module 6: The Wittig Reaction

- Mechanism and application of the Wittig reaction
- Examples: Synthesis of alkenes from phosphonium ylides
- Reaction conditions and variations

Module 7: The Diels-Alder Reaction

- Mechanism and stereochemistry of the Diels-Alder reaction
- Examples: Cycloaddition of dienes and dienophiles
- Applications in natural product synthesis

Module 8: The Michael Addition

- Mechanism and application of the Michael addition
- Examples: Conjugate addition to α,β-unsaturated carbonyl compounds
- Applications in the synthesis of complex molecules

Module 9: The Claisen Condensation

- Mechanism and application of the Claisen condensation
- Examples: Formation of β-ketoesters

- Variations and applications

Module 10: The Buchwald-Hartwig Reaction

- Mechanism and application of the Buchwald-Hartwig coupling
- Examples: Arylation of amines
- Applications in drug discovery and material science

Module 11: The Suzuki-Miyaura Coupling

- Mechanism and application of the Suzuki-Miyaura reaction
- Examples: Cross-coupling of aryl and vinyl boronic acids with halides
- Applications in pharmaceuticals and materials

Module 12: Advanced Applications and Recent Developments

- Recent advancements in name reactions
- Case studies showcasing modern applications and innovations
- Future directions and research trends

LEARNING OUTCOMES

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

- Concept Understanding
  (Grasp the fundamental principles and importance of name reactions in organic chemistry)
- Reaction Mechanisms
  (Learn the detailed mechanisms and conditions for key name reactions)
- Reaction Applications
  (Recognize how name reactions are applied in organic synthesis and pharmaceuticals)
- Functional Group Transformations
  (Understand the role of name reactions in transforming functional groups)
- Problem-Solving Skills
  (Develop the ability to apply name reactions to solve synthetic challenges)

REFERENCES

1. "Name Reactions: A Collection of Detailed Mechanisms and Synthetic Applications" by Jie Jack Li and K. R. C. P. Lee (Publisher: Wiley).
2. "Advanced Organic Chemistry: Reactions, Mechanisms, and Structure" by Jerry March (Publisher: Wiley).
3. "Organic Chemistry: Structure and Function" by K. Peter C. Vollhardt and Neil E. Schore (Publisher: W. H. Freeman).
4. "Organic Chemistry" by Clayden, Greeves, and Warren (Publisher: Oxford University Press).
5. "Modern Organic Synthesis: An Introduction" by Paul R. Schwartz and Michael B. Smith (Publisher: W. H. Freeman).

ISSUE OF MARKSHEET AND CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of course coordinator at the end of programme.

1. After successful completion of the course, no marks will be given to students only grades will be given as per follows

Percentage Range of Marks (Theory + Practical)	Remarks
90-100	O
80-90	A
60-80	B
40-60	C
<40	F

COURSE COORDINATOR:

Dr. Dharmesh Mahajan,
HoD, Chemistry Department,
GSC Vankal.