SVKM'S
NMIMS
Deemed to be UNIVERSITY

Sunandan Divatia School of Science

(SDSOS)

B.Sc. Biomedical Science

- **Program Educational Objectives (PEOs)**
- **Program Outcomes (POs)**
- **Course Outcomes (COs)**

Program Educational Objectives (PEOs):

1. **Professional Skills**
2. **Career Growth**
3. **Higher Studies**

Program Outcomes (POs):

PO-1: Students will have an understanding of basic concepts of Biology and applications of interdisciplinary subjects in Biology.

PO-2: Students will have understanding of clinical and medical aspects of Biology

PO-3: Students will be able to integrate the theoretical concepts and ideas learnt in lectures with experimental skills

PO-4: Students will be proficient in the use of both classical and modern tools (e.g., instrumentation, techniques, software) for laboratory based research

PO-5: Students will gain knowledge of computational languages and tools for applications in Biological research

PO-6: Students will be able to formulate hypotheses, plan and carry out experimental work independently, analyse the data/salient findings, and effectively communicate the research outcome

PO-7: Students will have domain knowledge essential for Industries such as clinical research, Healthcare, Pharma and I

PO-8: Students will understand the role of communication in personal and professional success and will learn the theoretical perspectives and approaches on leadership

PO-7: Students will have community awareness and will be more sensitive towards social issues

Courses and Course Outcomes (COs):

Microbiology

- **CO-1:** Explain various microbes and their characteristics, importance and classification.
- **CO-2:** Understand the different techniques used to study microbes.
- **CO-3:** Explain the applications of Microbiology.

Evolution and Adaptation

- **CO-1:** Explain the Darwinian concepts of evolution
- **CO-2:** Express evolutionary changes using Hardy Weinberg law
- **CO-3:** Understand and explain concept of adaptation and extinction

Anatomy and Physiology

- **CO-1:** Use anatomical terminology to identify and describe locations of major organs of each system covered.
- **CO-2:** Explain interrelationships among molecular, cellular, tissue and organ functions in each system.
- **CO-3:** Describe the interdependency and interactions of the systems.
- **CO-4:** Explain contributions of organs and systems to the maintenance of homeostasis.

Physical and Bioanalytical Chemistry

- **CO-1:** The principles and applications of ionic equilibria and various laws of thermodynamics
- **CO-2:** Applications of various analytical techniques used in the field of biology

Mathematics for Biologists

- **CO-1:** Appreciate mathematics as an essential and relevant part of life
- **CO-2:** Demonstrate interest, enjoyment and confidence in the pursuit and application of mathematical knowledge, skills and understanding to solve problems in the field of biology

- **CO-3:** Develop and demonstrate perseverance in undertaking mathematical challenges.

Effective Communication skills

- **CO-1:** Understand the role of communication in personal and professional success.
- **CO-2:** Develop awareness of appropriate communication strategies.
- **CO-3:** Prepare and present messages with a specific intent.
- **CO-4:** Analyze a variety of communication acts.

Practical 1

- **CO-1:** To calculate blood parameters such as clotting time, haemoglobin level, specific gravity, osmolarity, number of erythrocytes
- **CO-2:** To understand the histology of various endocrine glands
- **CO-3:** To operate common instruments such as pH meter, autoclave, analytical balance, laminar air flow and bright field microscope to study microorganisms

Practical 2

- **CO-1:** Stain and identify microorganisms using specific stains
  CO-2: Study the growth characteristics of microorganism
- **CO-3:** Check the efficiency of sterilization
- **CO-4:** Propagate microorganisms and estimate their numbers
- **CO-5:** Separate specific biomolecules based on their size, charge and solubility

Microbial Physiology

- **CO-1:** Explain the microbial cultivation methods, practices and requirements
- **CO-2:** Describe the different types of bacterial growth mechanism
- **CO-3:** Understand the various microbial processes to fix carbon and harness energy

Environmental Studies

- **CO-1:** Understand and explain various natural resources and associated issues
- **CO-2:** List different types of ecosystems and its regulators
- **CO-3:** Understand biodiversity and need for its conservation
- **CO-4:** Explain different types of environmental pollution and its adverse effects

- **CO-5:** List various acts framed to prevent environmental degradation

Genetics

- **CO-1:** Explain the Mendelian inheritance of traits
- **CO-2:** Describe the factors that regulate sex determination
- **CO-3:** Understand and explain factors that induce mutations
- **CO-4:** Explain quantitative inheritance

Biochemistry: Biomolecules

- **CO-1:** Describe various types of carbohydrates, its isomers and biological importance
- **CO-2:** Understand various types lipids, composition and function
- **CO-3:** Describe structure of proteins and nucleic acids, structure and function
- **CO-4:** Explain different vitamin, structure and function

Biophysics

- **CO-1:** Describe the principles of electromagnetic radiation, spectroscopy and its application for studying biological materials
- **CO-2:** Explain the physical laws that govern the biological membranes and activity
- **CO-3:** Describe the use of radioactive materials in biological research

Leadership Skill Building

- **CO-1:** Understand multiple theoretical perspectives and approaches on leadership
- **CO-2:** Recognize the psychological, organizational, and social factors that impact the leadership process in a critical manner
- **CO-3:** Master the concepts and technical vocabulary of leadership and use that technical language in the appropriate contexts
- **CO-4:** Understand the critical factors involved in leadership development and develop and improve their own leadership style

Practical 1

- **CO-1:** Prepare different microbial growth media and enumeration of bacteria by different methods
- **CO-2:** Check for effect of physical parameters on bacterial growth

- **CO-3:** Check the oligodynamic action of metals on bacterial growth
- **CO-4:** Use statistical methods to study pedigree analysis
- **CO-5:** Understand Hardy-Weinberg Law using simulations
- **CO-6:** Predict genetic crosses using probability theory

Practical 2

- **CO-1:** Make solutions or buffers of different molar or normal strength
- **CO-2:** Use chemical reactions to detect biological macromolecules such as DNA, Lipids, Proteins etc.
- **CO-3:** Use spectrophotometer for determining different parameters such as viscosity, structure, concentration and purity of biological macromolecule.

Social Involvement Program

- **CO-1:** Understand issues of society and will have community awareness.
- **CO-2:** Be more sensitive towards various social issues.

Bioprocess Technology

- **CO-1:** Fermentation and fermenters
- **CO-2:** Quality Assurance
- **CO-3:** Scale-up, Scale-down and downstream processes

Systematics and Diversity

- **CO-1:** Describe the various systems of animal classification
- **CO-2:** Describe the salient features of different classes of invertebrates
- **CO-3:** Describe the salient features of different classes of vertebrates

Cell Biology

- **CO-1:** Describe the cellular and sub cellular structures and functions
- **CO-2:** Explain the complex cell proliferation regulation
- **CO-3:** Enumerate the various molecules required for cell to cell communication
- **CO-4:** Describe Techniques involved in cell biology

Inorganic and Organic Chemistry

- **CO-1:** Describe atomic structure and atomic orbitals
- **CO-2:** Describe the mechanism of chemical bonding
- **CO-3:** Explain the intermolecular interactions

Biostatistics

- **CO-1:** Understand types of data, and appropriate statistical tools for their analysis.
- **CO-2:** Describe data using tables, graphs, or numbers
- **CO-3:** Understand and use probability distributions
- **CO-4:** Use statistics for generalizations and decision making
- **CO-5:** Evaluate statistical conclusions based on experimental design

Project Management Skills

- **CO-1:** Explain and practice project management, which involves various elements, planning, scheduling, qualities of leadership and teamwork

Practical 1

- **CO-1:** Screen and isolate antibiotic or vitamin B12 producing bacteria
- **CO-2:** Enrich and characterize mutant via antibiotic selection technique
- **CO-3:** Study cell cycle in onion root tip and effect of colchicine on cell cycle
- **CO-4:** Work using aseptic techniques in biosafety cabinet followed by culture and maintenance, cryopreservation of cell lines

Practical 2

- **CO-1:** Estimate ions, and elements using titration and qualitative analysis of functional groups and their derivatization.
- **CO-2:** Use and apply concepts of : descriptive statistics, Linear correlation and regression, probability, parametric and non-parametric test

Environmental Biotechnology

- **CO-1:** Explain composting and generation of biofuels
- **CO-2:** Understand and explain use of biological organisms to remove pollutants
- **CO-3:** Explain use of biotechnology for environment conservation

Immunology

- **CO-1:** List the various cell types of the immune system
- **CO-2:** Describe the concept of antigen and antibodies

  CO-3: Explain structure and function of major histocompatibility complex and compliment system
- **CO-4:** Describe the types of immune responses
- **CO-5:** Molecular biology techniques used in immunology

Developmental Biology

- **CO-1:** Explain the process of gametogenesis and fertilization
- **CO-2:** Understand and explain the process of gastrulation and organogenesis
- **CO-3:** Describe the function of all extraembryonic membranes
- **CO-4:** Understand and explain implications of developmental biology

Clinical Nutrition

- **CO-1:** Describe nutrition and nutritional disorders
- **CO-2:** List the methods of assessing nutritional status
- **CO-3:** Describe designing of diet for lifestyle disorders
- **CO-4:** Explain the importance of proper diet in treatment of various diseases

Biochemistry: Metabolism

- **CO-1:** Understand the catalytic role of enzymes, importance of enzyme inhibitors in design of new drugs, therapeutic and diagnostic applications of enzymes.
- **CO-2:** Understand the metabolism of nutrient molecules in physiological and pathological conditions.

Introduction to Excel and R

- **CO-1:** Do data analysis on MS Excel and have hands on knowledge of the same
- **CO-2:** Learn tools and techniques for Statistical analysis and Data transformation
- **CO-3:** Understand Data Mining techniques and their implementation
- **CO-4:** Analyze Data using Machine Learning algorithms in R

Practical 1

- **CO-1:** Identify blood groups, perform total leukocyte count
- **CO-2:** Perform DOT ELISA
- **CO-3:** Identify different stages of development such as gastrulation, organogenesis, extraembryonic membranes from chick embryo and Drosophila

Practical 2

- **CO-1:** Plan and calculate various types of diets
- **CO-2:** Plan diets for specific cases such as Anemia and vitamin deficiencies
- **CO-3:** Isolate lipids and determine saponification value
- **CO-4:** Isolate, estimate and partially purify acid phosphatase
- **CO-5:** Study the activity of purified enzyme

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Parasitology and Virology

- **CO-1:** Describe the taxonomic principles for the subdivision of viruses and describe the characteristics of the most important human pathogenic viruses and parasites.
- **CO-2:** Describe the infection process at the organism level
- **CO-3:** Describe pathogenesis, epidemiology and life cycle of parasites and viruses

Molecular Biology: DNA & Replication

- **CO-1:** Describe the mechanism of DNA replication process in a cell.

Neurobiology and Clinical Psychology

- **CO-1:** Explain organization and communication mechanism in the nervous system
- **CO-2:** Understand the mode of signal transduction in sensory nervous system
- **CO-3:** Describe the various cognitive functions of the brain
- **CO-4:** Understand and explain the Psychological processes

Alternative Systems of Medicine

- **CO-1:** Describe the historical development of alternative system of medicine in India.
- **CO-2:** Enlist and describe AYUSH system of medicine and non AYUSH system of medicine.
- **CO-3:** Describe the administrative infrastructure for management of plural systems in medical education and public health.

Pharmacology and Toxicology

- **CO-1:** Understand general principles of pharmacology
- **CO-2:** Enlist steps involved in drug discovery and development
- **CO-3:** Explain the different aspects of clinical pharmacology
- **CO-4:** Describe types of toxins, their metabolism and toxicity testing

Research Methods

- **CO-1:** The course will help to make students productive member of their supervisor's lab without repetitive training across lab groups

Practical 1

- **CO-1:** Understand and explain life cycle of protozoans, round worms and vectors.
- **CO-2:** Enlist the various detection methods of viruses from serum or blood based.
- **CO-3:** Isolate DNA from eukaryotic or prokaryotic cell
- **CO-4:** Dissect and display of nervous system of invertebrates and vertebrates.
- **CO-5:** Identify of brain from histological slides

Practical 2

- **CO-1:** Prepare different solutions required for dissolution of drugs
- **CO-2:** Perform experimental pharmacological assays using animal simulations
- **CO-3:** To perform in vitro antimicrobial activity of drug
- **CO-4:** Prepare standard operating procedures for use, validation and calibration of commonly used laboratory instruments.

Medical Microbiology

- **CO-1:** Understand the various mechanisms of infection
- **CO-2:** Understand various clinical lab techniques
- **CO-3:** Know the different on control measures of diseases

Molecular Biology: Transcription and Translation

- **CO-1:** Describe the mechanism of Transcription and Translation process in a cell.

Pharmaceutical Industry and Clinical Research

- **CO-1:** Describe steps and their importance in clinical trial process
- **CO-2:** Explain the importance of documentation in clinical trials
- **CO-3:** Describe various aspects of clinical trials such as auditing, inspection, outsourcing and financing.

Pathology

- **CO-1:** Interpret signs and symptoms elicited in a patient's history and create a differential diagnosis
- **CO-2:** Interpret laboratory data
- **CO-3:** Anticipate the natural course of disease
- **CO-4:** Understand possible avenues of medical or surgical therapy
- **CO-5:** understand gross pathology and histopathology
- **CO-6:** develop basic understanding of diagnostic laboratory evaluation and of the relationship between laboratory and morphological changes in diseases states

Bioinformatics

- **CO-1:** Describe about basics, data and databases, analysis used in Bioinformatics
- **CO-2:** Use the tools available for sequence and structure analysis

Project

- **CO-1:** Show independence, critical and creative thinking
- **CO-2:** Make work plan for the experimental work
- **CO-3:** Perform a research project according to an individual study plan
- **CO-4:** Apply experimental methods to solve a given scientific task
- **CO-5:** Collect data for evaluation and for statistical treatment, if relevant
- **CO-6:** Interpret both processes and outcomes of research
- **CO-7:** Use relevant scientific literature
- **CO-8:** Identify how failures or successes may shape further research questions or goals

Practical 1

- **CO-1:** Identify bacteria from colony morphology and biochemical characteristics
- **CO-2:** Grow specific bacterial species using differential media
- **CO-3:** Isolate RNA for eukaryotic and prokaryotic cell followed by synthesis of cDNA
- **CO-4:** Perform RT PCR to study expression of specific genes
- **CO-5:** Study phenomena of Diauxic growth
- **CO-6:** Study SNPs using quantitative PCR technique

Practical 2

- **CO-1:** Perform tissue processing, sectioning, staining, and histopathological observations.
- **CO-2:** Perform routine diagnostics tests for detection of various pathological conditions.
- **CO-3:** Use bioinformatics tools to search for sequences searching, phylogenetic analysis, primer design.

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