Department of Microbiology, Akal College of Basic Sciences

M.Sc. Microbiology

(Two Year Degree Programme)

Program Objectives	1. Demonstrate an ability to understand the potential of basic and applied microbiology in addressing the problems of society and public health. 2. Attain eligibility, skills and competency to pursue career in higher educational institutions, R&D laboratories, medical research, biological research, scientific writing, industries, diagnostic labs, quality control labs and food production houses. 3. Identify entrepreneurship potential of interdisciplinary microbiological & biotechnological education and their implementation to create job potential for others. 4. Inculcate continuous learning, work culture and professional ethics to adapt in a team and as a team leader in challenging and responsible position of education and research.
Program Outcomes	On completion of M.Sc. Microbiology programme, students will be able to apply the knowledge of microbiology and interdisciplinary allied sciences to understand the microbial life processes & interactions *in vitro* and *in vivo* and their impact on environment & human life. Learners will be able to identify the research problems, search research literature, use appropriate research methodology, statistical analysis and data interpretation to apply reasoning obtained through the contextual knowledge to assess impact of microorganisms on the society, environment and public health. Learners will be able to apply ethical principles and professional ethics at position of responsibilities and to work effectively as an individual, and as a team member or team leader in multidisciplinary academic and research settings.
Program Specific Outcomes	1. At the end of M.Sc. Microbiology programme, learners will be able to understand the applications and importance of Environmental Microbiology, Industrial Microbiology, Food Microbiology, Medical Microbiology, Immunology, Agricultural Microbiology, Microbial Biotechnology and Biochemistry. 2. Learners will be able to design and perform experiments and execute a short research project incorporating techniques of basic and advanced microbiology. 3. Learners will demonstrate competent skills in handling various instruments, following standard microbial practices and safety guidelines at work places. 4. Learners will develop independent thinking and competence to carry out microbiological testing, quality control, microbial production, biopharmaceutical production, epidemiological work, diagnostic assays, research work, phylogenetic analysis, academic jobs and administrative responsibilities at various levels.

Course Specific Outcomes On completion of a specific course, the learners will be able to:	
General Microbiology	Understand the contributions of eminent scientists in the field of microbiology, various groups of microbial cells viz. bacteria, archaea, algae, fungi, protozoa, protists, viruses, prions; prokaryotic vs eukaryotic cells and microbial classification.

Microbial Metabolism	Understand the mechanism, process and types of metabolic pathways occurring in microbial cells related to ATP generation, respiration, fermentation, photosynthesis, anabolism, catabolism, enzyme kinetics, bioenergetics and DNA metabolism.
Immunology	Understand the structure, function and roles/applications of immune system, antigens, antibodies, APCs, humoral & cellular immunity, tissue transplantation, complement system, hypersensitivities, immunodeficiencies and autoimmune disorders.
Environmental Microbiology	Learn the concepts of biodegradation, bioremediation, wastewater treatment, solid waste treatment, bio-composting, biomining, biogeochemical cycles and symbiosis.
Food & Dairy Microbiology	Acquire knowledge of types of foods, importance of microbes in food production, dairy fermented foods, food spoilages, Pasteurization, preservation methods, food infections, food intoxication, MAP, HACCP, food certification, water quality analysis, coliforms, aseptic packaging and public health.
Industrial Microbiology & Fermentation Technology	Understand the scope of industrial microbiology, strain improvement, IPRs, design & types of bioreactors/fermenters, commercial production of alcoholic beverages, dairy products, bakery products, vitamins, colours, flavouring agents, antibiotics, steroids, microbial enzymes, bioethanol, biofuels, bioplastics, microbial construction materials, polysaccharides and upstream & downstream processing.
Medical & Diagnostic Microbiology	Understand about normal microbiota, pathogenic microbes, infectious diseases, pandemic, epidemic, pathogenesis, laboratory diagnosis, blood culture systems, antibiotics, antimicrobials, MIC testing, biopharmaceuticals, disease transmission, public health, ESKAPE, NTDs and drug resistance.
Molecular Biology	Understand about DNA, RNA, proteins, replication, transcription, translation, PTMs, cloning vectors, gene libraries, recombinant DNA, gene regulation, PCR, blotting techniques, DNA fingerprinting, genetic engineering, GMOs and recombinant products.
Biostatistics	Learn the basic knowledge of probability, distributions, means, standard deviation, correlation, skewness, kurtosis, testing of goodness of fit by applying chi square and t- test, ANOVA and statistical software packages.
Computation Biology & Bioinformatics	Understand computer hardware & software, networking protocols, multimedia applications, information technology, bioinformatics tools, biological databases, softwares for sequence alignment, phylogenetic analysis and data interpretation.
Research Methodology	Acquire knowledge research problem, objectives of research, experimental design, data collection, data analysis & interpretation, hypothesis testing procedures, ethics in research, plagiarism, scientific writing, thesis submission and scientific publishing, peer-review process.
Dissertation	Acquire ability to identify the research topic, design objectives, utilize journals & e-resources for literature survey, technical skills in carrying out experiments, operation of sophisticated analytical instruments, data collection, analysis & interpretation, competent scientific writing, effective communication & presentation skills and thesis writing & submission.