



**Shobhit
University**

EDUCATION EMPOWERS

Babu Vijendra Marg, Adarsh Institutional
Area Gangoh, Distt. Saharanpur (U.P.)
247341, India
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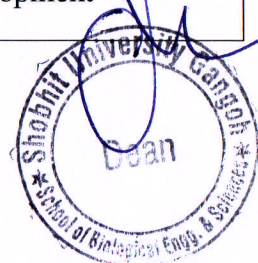
School of Biological Engineering & Sciences

Master of Science (Microbiology)

Program Outcomes, Program Specific Outcomes & Course Outcomes
(POs, PSOs& COs)

Program Outcomes

Program Outcome		Statement
PO 1	Engineering* (Area Specific) Knowledge	Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem Analysis	Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO 3	Design/ Development of Solutions	Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
PO 4	Conduct investigations of complex problems	Conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
PO 5	Modern Tool Usage	Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	The Engineer* (Area Specialist) and Society	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO 7	Environment and Sustainability	Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development





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PO 8	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
PO 9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PO 10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO 11	Project Management and Finance	Demonstrate knowledge and understanding of engineering and management principles and apply these to owners own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long Learning	Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.





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Program Specific Outcomes (PSOs)

Program Specific Outcome	Statement
PSO 1	Specialized Knowledge: demonstrate a comprehensive understanding of microbiological concepts, theories, and principles, encompassing various subfields such as medical, environmental, industrial, and agricultural microbiology.
PSO2	Laboratory Skills: Students will possess proficient laboratory skills, including the ability to perform a range of microbiological techniques such as culturing, isolation, identification, and characterization of microorganisms, as well as molecular biology and bioinformatics techniques.
PSO 3	Critical Thinking and Problem-Solving: Student will be able to critically analyze microbiological data, identify research gaps, formulate research questions, design experiments, and interpret results to address scientific and practical challenges in microbiology.
PSO 4	Continuous Learning and Adaptability: Students will recognize the importance of lifelong learning and professional development in the field of microbiology, staying abreast of emerging trends, technologies, and methodologies.
PSO 5	Application of Microbiological Knowledge: Students will apply their microbiological knowledge and skills to address real-world problems, innovate new technologies, develop biotechnological products, or contribute to public health and environmental sustainability.





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Course Outcomes (COs)

1st Semester

Course: Cell and Developmental Biology

Course Outcomes	Statement
CO 1	Students will acquire knowledge about basics of cell biology.
CO 2	Students will learn about how various functions of organelles and their working.
CO 3	Students will gain an insight into microscopic structures and chemical components of various regions of cells.
CO 4	Students will attain a comprehensive knowledge of functioning of cell and synchronization of activities of various organelles.
CO 5	Students will be able to learn about various signaling mechanism involved in a cell which ultimately leads to a visible physiological response.

Course: Human Pathology

Course Outcomes	Statement
CO 1	Gain knowledge about basic cell structures, functions of organelles, and their working mechanisms.
CO 2	Understand mechanisms of cell injury, including reversible and irreversible damage.
CO 3	Understand the role of molecular mediators, morphological effects, and outcomes of inflammatory responses.
CO 4	Study the processes of tissue renewal, cutaneous wound healing, and liver tissue remodeling in conditions like cirrhosis.
CO 5	Explore cancer staging, grading, and mechanisms of tumor growth, invasion, and metastasis.





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Course: Cytology

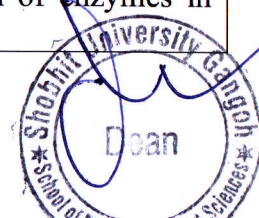
Course Outcomes	Statement
CO 1	Basic chemical composition of living matter.
CO 2	Structural characteristics of prokaryotic and eukaryotic cells.
CO 3	Taxonomy and characteristics of the major kingdoms.
CO 4	Basic concepts of bioenergetics, photosynthesis, and cellular respiration.
CO 5	Mechanics of cellular reproduction.

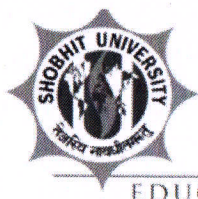
Course: Toxicology and Forensic Science

Course Outcomes	Statement
CO 1	Students will become familiar with how forensic scientists work.
CO 2	Students will be able to learn the tools and techniques used in forensic science and how they reach the conclusions they present in court.
CO 3	Students will be familiarized with the creative, problem solving and inquiry based approach to investigate the crime scene.
CO 4	Students will be able to explain the characteristics of a fingerprint collect, process, and analyze fingerprint evidence and explain DNA analysis.

Course: Biochemistry & Enzymology

Course Outcomes	Statement
CO 1	Students will be able to define biomolecules and buffers.
CO 2	Students will understand the structure and functions of biomolecules.
CO 3	Students will be able to classify and explain the role of various biomolecules in human body.
CO 4	Students will be able to analyze the causes of diseases on biochemical basis.
CO 5	Students will be able to understand the application of enzymes in daily life.





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Course: Elements of Biochemistry

Course Outcomes	Statement
CO 1	Students will be able to define biomolecules and buffers.
CO 2	Students will understand the structure and functions of biomolecules.
CO 3	Students will be able to analyze the causes of diseases on biochemical basis.
CO 4	Students will be able to classify and explain the role of various biomolecules in human body.
CO 5	Students will be able to understand various biochemical process and cell metabolism.

Course: Concept in Medicinal Chemistry & Drug Development

Course Outcomes	Statement
CO 1	Students will be able to explain the relationship between structure and biological activity of various drug molecules.
CO 2	Students will be able to understand the most of various classes of drug molecules.
CO 3	Students will be able to identify the roles of oncogenes, tumor suppressor genes, DNA repair genes, and cancer stem cells in malignancies.
CO 4	Students will be able to grasp the differences between acute and chronic inflammation.
CO 5	Students will be able to develop insights into edema, hyperemia, hemorrhage, thrombosis, embolism, infarction, and shock.

Course: Biophysics

Course Outcomes	Statement
CO 1	To Learn understanding and appreciation of biophysics as an interdisciplinary research field.
CO 2	To Understand the link between the structure and functions of biological system from molecular to system level.
CO 3	To get insight on how experimental methods and theoretical approaches from physics can give answers related to the structure and functions of biological systems.
CO 4	To understand the diffusion processes and their role in the transport phenomena across the biological membrane.
CO 5	To understand the relationship of the membrane transport mechanisms and the electrical activity of the cell.





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Course: Bacteriology

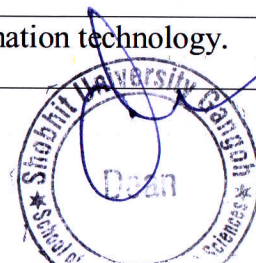
Course Outcomes	Statement
CO 1	Students will have knowledge of structure function and application of microorganism.
CO 2	Students will be skilled to handle microorganisms in laboratory.
CO 3	Students will be able to explain the principles and techniques for bacterial culture, isolation, and identification.
CO 4	Students will be able to demonstrate knowledge of sterilization techniques, disinfection methods, and antimicrobial agents.
CO 5	Students will be able to perform aseptic techniques, media preparation, and microbial counting methods.

Course: Virology

Course Outcomes	Statement
CO 1	Students will be able to differentiate the nature of viruses, laboratory diagnosis of viruses using different techniques and classification of viruses.
CO 2	Students will be able to explain the mechanisms of viral replication cycles in both DNA and RNA viruses.
CO 3	Students will be able to understand viral entry strategies, genome integration, and host-virus interactions.
CO 4	Students will be able to perform diagnostic techniques such as ELISA, PCR, RT-PCR, and viral culture for virus identification.
CO 5	Students will be able to understand plaque assays, haemagglutination tests, and molecular methods for viral load estimation.

Course: Computer Applications & Biostatistics

Course Outcomes	Statement
CO 1	Define and appropriately use information technology terms.
CO 2	Identify computer hardware components and describe their function.
CO 3	Identify and describe telecommunication components.
CO 4	Use a hypertext markup language to produce basic Web documents.
CO 5	Compare the roles of different sectors of the information technology.





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Course: Professional Communication

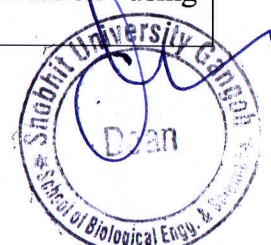
Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Construct the vocabulary of the students to assist them acquire plethora of knowledge of foreign as well as indigenous languages.
CO 3	Maximize the capability of students pertaining to discussion initiation, carrying on and conclusion.
CO 4	Provide knowledge in the area of research.
CO 5	Utilize the already learnt grammar skills towards accurate usage of language.

Course:Public Speaking

Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Construct the vocabulary of the students to assist them acquire plethora of knowledge of foreign as well as indigenous languages.
CO 3	Maximize the capability of students pertaining to discussion initiation, carrying on and conclusion.
CO 4	Help demonstrate proficiency in written communication using appropriate style, structure and voice.
CO 5	Provide knowledge in the area of research.

Course:Effective writing skills I

Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Construct the vocabulary of the students to assist them acquire plethora of knowledge of foreign as well as indigenous languages.
CO 3	Utilize the already learnt grammar skills towards accurate usage of language.
CO 4	Provide knowledge in the area of research.
CO 5	Help demonstrate proficiency in written communication using appropriate style, structure and voice.





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Course: English Grammar I

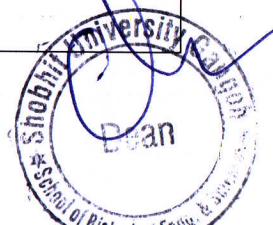
Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Construct the vocabulary of the students to assist them acquire plethora of knowledge of foreign as well as indigenous languages.
CO 3	Utilize the already learnt grammar skills towards accurate usage of language.
CO 4	Provide knowledge in the area of research.
CO 5	Help demonstrate proficiency in written communication using appropriate style, structure and voice.

Course: Seminar & Research Orientation

Course Outcomes	Statement
CO 1	Lectures, seminars, and practical exercises that cover themes like what constitutes scientific knowledge.
CO 2	How to identify and work through research problems.
CO 3	How to become familiar with sources and critique them, and how to research secondary sources.
CO 4	How to use research database tools.
CO 5	How to prepare preliminary interdisciplinary research proposals.

Course: Research Methodology

Course Outcomes	Statement
CO 1	Students who complete this course will be able to understand and comprehend the basics in research Methodology.
CO 2	And applying them in research/ project work.
CO 3	This course will help them to select an appropriate research design.
CO 4	Data Analysis
CO 5	Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.





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Course: General Proficiency

Course Outcomes	Statement
CO 1	The ability to exchange ideas and information in a way that builds trust and respect.
CO 2	The ability to explore issues and ideas before forming a conclusion.
CO 3	The ability to synthesize knowledge across different domains and perspectives.
CO 4	Preparing students to be engaged citizens.
CO 5	Preparing students to participate in political culture and thrive in a rapidly evolving world.

Course: Enterprenuership Development and Business Communication I

Course Outcomes	Statement
CO 1	To familiarize the students, and make them understand with key concepts and processes in entrepreneurship and business communication.
CO 2	To provide context to the processes in the form of differences between small and large firms, and the economic environment.
CO 3	To introduce key debates around entrepreneurship and small businesses.
CO 4	To impart knowledge on different extension methods and approaches used for transfer of agricultural technology.
CO 5	To impart skills required for entrepreneurship development among the students for self-employment.

Course: Human Values and Moral Ethics I

Course Outcomes	Statement
CO 1	Students become aware of their life's mission, vision, and goals.
CO 2	Students learn to cultivate virtues and avoid vices.
CO 3	Students learn to understand the metaphors of ethical personalities From various domains.
CO 4	Students develop a personality that allows them to view life in a positive way.
CO 5	Building strong relationships.





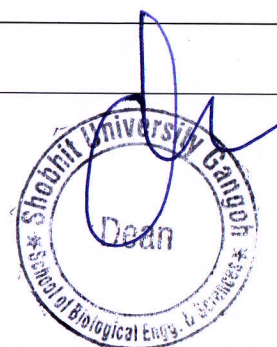
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Course: Life Management I

Course Outcomes	Statement
CO 1	How to set SMART goals that are specific, measurable, achievable, realistic, and have a time frame.
CO 2	How to prioritize tasks and effectively manage time.
CO 3	How to manage stress and improve work-life balance.
CO 4	How to organize work and use organization tools.
CO 5	How to delegate tasks and assignments.





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Course Outcomes (COs) 2nd Semester

Course: Immunology & Immunotechnology

Course Outcomes	Statement
CO 1	Students will be able to understand and appreciate the contribution of various scientists in unraveling the various facets of immune system and responses in our body.
CO 2	Students will be able to understand various factors responsible for causation of tumor and subsequently cancer in the body.
CO 3	Students will be able to understand the structure and function of various cells and organs of immune system.
CO 4	The role of MHC molecule in graft rejection along with structure and function of various types of MHC in body will be understood by the students.
CO 5	Students will be able to understand the structure and function of various cells and organs of immune system.

Course: Molecular Biology & Recombinant DNA Technology

Course Outcomes	Statement
CO 1	The student will be familiar with the historical background and important milestones, biosafety and bioethics in genetic engineering.
CO 2	The student will be acquainted with tools of RDT like enzymes, vectors and hosts.
CO 3	The student will be acquainted with technical knowhow of gene cloning and expression and factors for optimizing the heterologous gene expression.
CO 4	The student will be acquainted with the techniques required for gainful applications of genetic engineering.
CO 5	The student will be able to apply RDT in different domains of life science, medical, agriculture, forensic and allied fields for the welfare of living beings.





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Course: Mycology & Phycology

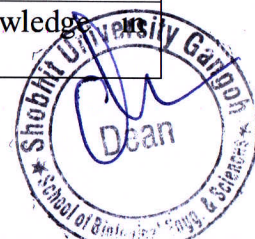
Course Outcomes	Statement
CO 1	Students will be able to isolate fungi from soil.
CO 2	Students will be able to learn about the cultivation and preservation of fungi and algae.
CO 3	Students will be able to recognize the microscopic structure of fungi.
CO 4	Students will be able to recognize the microscopic structure of algae.
CO 5	Students will be able to economic importance of algae as primary producers and commercial products.

Course: IPR, Biosafety & Bioethics

Course Outcomes	Statement
CO 1	Students will understand with the importance of intellectual property and its protection under the constitution, able to classify patentable subject matter under the realm of Biotechnology.
CO 2	Students will be able to understand the protection of traditional knowledge.
CO 3	Students will be able to apply their knowledge to deal with hazards related to biotechnology and the importance of biosafety in research.
CO 4	Students will be familiar with the basic principles of bioethics & will be able to analyze ethical issues related to biotechnology research.
CO 5	Students will be able to understand the concept of lab biosecurity.

Course: Bioinstrumentation Techniques

Course Outcomes	Statement
CO 1	Students will be able to define and explain the fundamental principles of modern biological techniques.
CO 2	Students will be able to understand types of chromatography on the basis of different mobile and stationary phases.
CO 3	Students will acquire knowledge about principle and applications of different types of electrophoresis.
CO 4	Students will be able to learn about the general principles and applications of different types of microscopy.
CO 5	Students will be able to apply their basic knowledge and characterization of biomolecules.





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Course: Career Skills

Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Enhance the Vocabulary of the students to make them corporate ready.
CO 3	Improve the Logical ability among the students.
CO 4	Enhance the problem solving skills of the students.
CO 5	Improve the Quantitative ability of the students.

Course: Public Speaking II

Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Construct the vocabulary of the students to assist them acquire plethora of knowledge of foreign as well as indigenous languages.
CO 3	Maximize the capability of students pertaining to discussion initiation, carrying on and conclusion.
CO 4	Help demonstrate proficiency in written communication using appropriate style, structure and voice.
CO 5	Provide knowledge in the area of research.

Course: Effective writing skills II

Course Outcomes	Statement
CO 1	Exhibit competent writing that is reasonably proficient in correct grammar and sentence structure skills.
CO 2	Construct the vocabulary of the students to assist them acquire plethora of knowledge of foreign as well as indigenous languages.
CO 3	Maximize the capability of students pertaining to discussion initiation, carrying on and conclusion.
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Course: English Grammer II

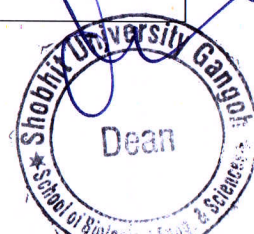
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Course: Seminar & Research Orientation II

Course Outcomes	Statement
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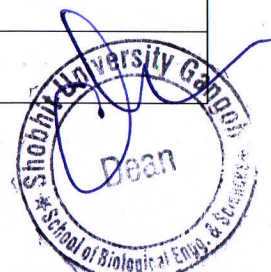
Course Outcomes	Statement
CO 1	CO-1The ability to exchange ideas and information in a way that builds trust and respect.
CO 2	The ability to explore issues and ideas before forming a conclusion.
CO 3	The ability to synthesize knowledge across different domains and perspectives.
CO 4	Preparing students to be engaged citizens.
CO 5	Preparing students to participate in political culture and thrive in a rapidly evolving world.

Course: Enterprenuership Development and Business Communication II

Course Outcomes	Statement
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CO 4	To impart knowledge on different extension methods and approaches used for transfer of agricultural technology.
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Course: Human Values and Moral Ethics II

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Course: Life Management II

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Course Outcomes (COs)

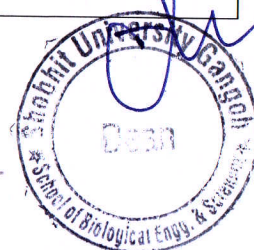
3rd Semester

Course: Microbial Genetics

Course Outcomes	Statement
CO 1	Students will be able to understand the current status of microbial genetics.
CO 2	Students will be able to understand the relevance of microbial genetics in Life Sciences.
CO 3	Students will be able explain different mechanisms of transfer of genetic materials in prokaryotes.
CO 4	Students will be able to know about transposons and transcription.
CO 5	Students will be able to understand life cycles of different phages.

Course: Medical Microbiology

Course Outcomes	Statement
CO 1	This course provides learning opportunities in the basic principles of medical microbiology and infectious disease.
CO 2	It covers mechanisms of infectious disease transmission, principles of aseptic practice, and the role of the human body normal micro flora.
CO 3	Helps to understand the use of lab animals in medical field.
CO 4	Recall the relationship of this infection to symptoms, relapse and the accompanying pathology.
CO 5	Helps to understand the use of lab animals in medical field.





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Course: Bioinformatics

Course Outcomes	Statement
CO 1	Students will be able to understand the structure and function of computers along with its application in solving Biotechnology problems.
CO 2	Students will acquire the ability to retrieve, use and apply tremendous knowledge present in various databases for research purpose.
CO 3	Students will be able to perform interspecies genome analysis and also understand the phylogenetic relationship between different species.
CO 4	Students will become familiar with various application tools available for various purposes like protein structure prediction, primer designing, nucleic acid structure prediction and molecular mapping and imaging.
CO 5	The knowledge of various data generation techniques & intervention of Bioinformatics into it, in the form of software for generating restriction map, chromatograms etc. will be imparted to students.

Course: Environmental Microbiology

Course Outcomes	Statement
CO 1	Students will be able to acquire knowledge about environmental pollution- sources, effects and control measures.
CO 2	Students will understand the concept of BOD and analyze the need for different waste water treatment methods.
CO 3	Students will be able to understand and implement the methods and importance of solid waste management.
CO 4	Students will be able to understand the application of bioreactors.
CO 5	Students will understand the role of bio pesticides.





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Course: Industrial Microbiology

Course Outcomes	Statement
CO 1	Students will be able to understand the technologies for microbial cell maintenance.
CO 2	Students will learn about bioprocess technology.
CO 3	Students will be able to understand fermenters.
CO 4	Students will be able to production of Secondary Metabolites.
CO 5	Students will be able to production Modern Biotechnology Products.

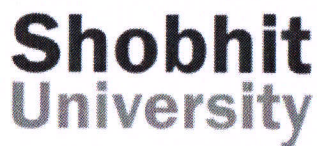
Course: Watershed Waste lands Management

Course Outcomes	Statement
CO 1	Students will be able to restoring ecological balance
CO 2	Students will be able to promoting economic development
CO 3	Students will be able to generating employment
CO 4	Students will be able to alleviating poverty
CO 5	Students will be able to empowering the community

Course: Biochemical Engineering

Course Outcomes	Statement
CO 1	Problem solving: Identifying, formulating, and solving complex engineering problems.
CO 2	Applying engineering design to create solutions that meet needs while considering safety, public health, and other factors.
CO 3	Communicating effectively with a variety of audiences
CO 4	Recognizing ethical and professional responsibilities in engineering situations.
CO 5	Functioning effectively in a team to establish goals & plan tasks.





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Course Outcomes	Statement
CO 1	Students will be able to understand the microorganisms of soil and nutrient cycle.
CO 2	Students will learn about the role of enzymes and toxins in pathogenesis.
CO 3	Students will understand about the physical and chemical control of plant diseases.
CO 4	Students will learn about Bio fertilizers& Mycorrhizae.
CO 5	Students will be able to categories of storage fungi.

Course Outcomes	Statement
CO 1	Students will be able to know about the microorganisms important in food microbiology.
CO 2	Students would know about the factors influencing microbial growth in food.
CO 3	Students will understand various food borne diseases.
CO 4	Students will also have knowledge of microbiology of milk.
CO 5	Students will understand microorganisms as source of food.

Course Outcomes	Statement
CO 1	Students will understand and analyze the current events and issues that are occurring in agriculture.
CO 2	Students will understand and analyze how current events and issues affect your future in agriculture.
CO 3	Students will be able to recognize and examine the relationships between inputs and outputs in their agricultural field to make effective and profitable decisions.
CO 4	Students will be able to media Planning and Advertising.
CO 5	Students will be able to ethics.





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Course: Poultry Production & Management

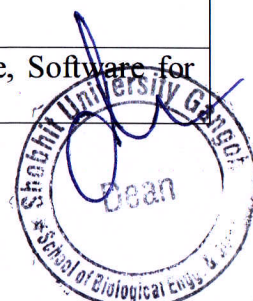
Course Outcomes	Statement
CO 1	Students will be able to know about the importance and contribution of poultry in meat sector in India as well as whole world.
CO 2	Students will be able to recognized different characteristics Indian and foreign breeds of chicken.
CO 3	Student will get information related to housing requirement of poultry such as floor space, different housing system their advantages and disadvantages.
CO 4	Student will be able to learn about various environmental conditions and different equipment used to maintain those conditions.
CO 5	Student will be able to know about various disease and vaccination which are used for poultry at different stage of their life.

Course: Seminar & Research Orientation III

Course Outcomes	Statement
CO 1	Describe the measurable skills, abilities, knowledge or values.
CO 2	Students should be able to demonstrate as a result of a completing a course.
CO 3	They are student-centered rather than teacher-centered.
CO 4	They describe what the students will do, not what the instructor will teach.
CO 5	Use research database tools.

Course: Research Methodology III

Course Outcomes	Statement
CO 1	Students who complete this course will be able to understand and comprehend the basics in research methodology.
CO 2	And applying them in research/ project work.
CO 3	This course will help them to select an appropriate research design.
CO 4	Data Analysis
CO 5	Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism.





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Course: General Proficiency III

Course Outcomes	Statement
CO 1	CO-1The ability to exchange ideas and information in a way that builds trust and respect.
CO 2	The ability to explore issues and ideas before forming a conclusion.
CO 3	The ability to synthesize knowledge across different domains and perspectives.
CO 4	Preparing students to be engaged citizens.
CO 5	Preparing students to participate in political culture and thrive in a rapidly evolving world.

Course: Enterprenuership Development and Business Communication III

Course Outcomes	Statement
CO 1	To familiarize the students, and make them understand with key concepts and processes in entrepreneurship and business communication.
CO 2	To provide context to the processes in the form of differences between small and large firms, and the economic environment.
CO 3	To introduce key debates around entrepreneurship and small businesses.
CO 4	To impart knowledge on different extension methods and approaches used for transfer of agricultural technology.
CO 5	To impart skills required for entrepreneurship development among the students for self-employment.

Course: Human Values and Moral Ethics III

Course Outcomes	Statement
CO 1	Students become aware of their life's mission, vision, and goals.
CO 2	Students learn to cultivate virtues and avoid vices.
CO 3	Students learn to understand the metaphors of ethical personalities From various domains.
CO 4	Students develop a personality that allows them to view life in a positive way.
CO 5	Building strong relationships.





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Course: Life Management III

Course Outcomes	Statement
CO 1	Student will be able to how to set SMART goals that are specific, measurable, achievable, realistic, and have a time frame.
CO 2	Student will be able to how to prioritize tasks and effectively manage time.
CO 3	Student will be able to how to manage stress and improve work-life balance.
CO 4	Student will be able to how to organize work and use organization tools.
CO 5	Student will be able to how to delegate tasks and assignments.

