

	Program :	B.Sc - Chemistry, Botany, Microbiology (CBM)		
	CHEMISTRY			
	PO Code	Programme Outcomes:		
	PO1	Analyze critically and evaluate constructively the concept of science and effectively bring out the knowledge derived from that, organize and apply that knowledge skillfully and ethically to provide constructive solutions to social, economic and environmental problems faced by the society globally.		
	PO2	Apply scientific theories and concepts to critically debate, evaluate and create solutions to meet the needs of social, economic and environmental requirements of the society.		
Semester	CourseCode	CourseName	CO Code	Course Outcomes
I	CHEM1F	Chemistry 1	CO1	Explain the basic concepts of mathematics for efficient learning and application in chemistry
			CO2	Apply appropriate techniques of analytical chemistry, conduct experiments, analyze data and interpret results with an understanding of the limitations
			CO3	Recall the basic concepts of atomic structure and identify patterns in molecular bonding and relate to their chemical properties
			CO4	Analyze, interpret and identify crystal systems using X-ray crystallography.

			CO5	Explain HSAB concepts, its applications in different areas and its limitations. Discuss the importance of different non-aqueous solvents, their chemical reactions and applications.
			CO6	Categorize the different binary solutions and deduce their behavior with change in external parameters.
			CO7	Predict the reactivity of an organic compound based on its structure, justify the mechanism based on chemical effects and develop systematic methods for the preparation of different compounds
			CO8	Recall the basic knowledge of organic chemistry to name new compounds and formulate their conformations.
2	CHEM2F	Chemistry 2	CO1	Apply the law of thermodynamics to thermal cycles, understand the significance of state variables, thermodynamic functions, illustrate their roles in determining equilibrium under different conditions and solve related problems.
			CO2	Explain the terms in phase rule and interpret the phase diagrams in uninary and binary systems
			CO3	Explanation of radioactivity, its measurement, major components of a nuclear reactor and applications of tracer techniques
			CO4	Illustrate methods to determine the molecular weight of inorganic polymers and discuss some commercially important polymers
			CO5	Understand the properties of coordination compounds, their structures and stability. Apply Crystal Field Theory to understand the magnetic properties and describe the stability of metal complexes using stepwise formation constant and thermodynamic parameters
			CO6	Create interest in different magnetic properties and functional properties of structural materials and smart materials

			CO7	Apply various rules to understand the stability of alkenes and reactions of dienes and alkynes
			CO8	Elaborate electrophilic substitution reactions of benzene under the influence of activating and deactivating groups. Predict aromaticity based on Huckel's rule and illustrate the molecular orbital picture of benzene.
III	CHEM3F	Chemistry 3	CO1	Identify the challenges in the conservation of water and design feasible solutions to overcome the limitations . Formulating and implementing green solutions to some of the reactions which are hazardous to the bio-system and sensitizing the younger generation chemists to design, produce and generate greener products.
			CO2	Interpret the basic concepts involved in inorganic analysis. Infer the knowledge of buffers and their biological applications.
			CO3	Explain the use of various industrial materials and their applications. Upgrade the conventional methods to design latest technologies for the economical and smarter production.
			CO4	Explore the dynamic world of nano materials, interpret their unique properties and discover the plethora of possibilities of their applications in various fields for a better and smarter life.
			CO5	Relate and examine the theories and concepts of electrochemistry. Develop deep knowledge of the application of measurements useful in analytical estimations.
			CO6	Enumerate the fundamentals of the kinetics of chemical reactions followed by a detailed study of catalysis.
			CO7	Understand the mechanisms to predict the outcome of various reactions. Relate elimination or substitution reactions to their energy profile diagrams

			CO8	Discuss in detail alcohols, phenols and epoxides. Understand and recall mechanisms of aromatic electrophilic substitution reactions. Describe the synthetic application of Grignard reagents.
IV	CHEM4F	Chemistry 4	CO1	Recall and integrate the characteristic properties of the lanthanoides and monitor their applications in revolutionizing industry and medical field. Identify and summarize the significance of organometallic compounds in the catalytic industry.
			CO2	Utilize the knowledge of the latest technology, skills and tools in the production field to generate smarter and economical products
			CO3	Compose and formulate ideas to create the much required energy harvesting sources like solar cells and fuel cells with the fundamental knowledge of the working of the electrochemical cells.
			CO4	Illustrate the effect of absorption of light by matter. Application of the photochemical processes in different fields
			CO5	Explain the principles and working of various instruments and application of these instruments for qualitative and quantitative analysis
			CO6	Classify polymers and explain the mechanism of polymerization. Differentiate thermosetting and thermosoftening polymers with special mention to commercially important polymers
			CO7	Recall the IUPAC nomenclatures. Detailed discussion of aldehydes and ketones
			CO8	Predict the mechanisms and compare the reactivity of different carboxylic acids and their derivatives. Understanding amines in detail and studying the various applications of biologically important amines

V	CHEM5BPF	Chemistry 5	CO1	Outline and exemplify the classification, reactions, properties and biological significance of proteins.
			CO2	Explain and understand the chemical structure, reactions, properties, function and use of broad range of food carbohydrates and various components of nucleic acids
			CO3	Contrast the structure of fats, phospholipids, steroids and explain various properties of the above macromolecules. Interpret the biological roles of diverse hormones and to study their mode of action
			CO4	Categorize enzymes based on their action and understand the kinetic parameters of enzymatic reactions. Illustrate the coenzyme function of water soluble vitamins and select appropriate methods to control harmful effects of synthetic vitamins
			CO5	Evaluate the basic theory and instrumentation of microwave, IR and UV/Vis spectroscopy as a qualitative and quantitative method.
			CO6	Understand the symmetry elements and the corresponding symmetry operations that lead to the classification of molecules into point groups
V	CHEM5OIF	Chemistry 6	CO1	Apply principles of coordination chemistry to explain how nature tailors properties of metal centers for specific applications in biochemical systems.
			CO2	Outline the types of catalysis and applications of certain well known and industrially important reaction-specific catalysts used globally.
			CO3	Imagine the structural formulae of organic compounds in a 3D perspective. Understand the importance of stereochemistry in organic chemistry and apply the knowledge gained in this course to a variety of chemical problems. Apply the knowledge in the synthesis, enantiomeric separation and characterisation of a range of chiral

				compounds in the laboratory for further research.
			CO4	Examine the enantiomers, diastereomers and epimers of simple sugars. Understand how the ring structures of aldehyde and ketone sugars are formed. Construct the ring structure of any 5 or 6 carbon containing monosaccharide from its corresponding straight chain structure.
			CO5	Outline various reaction mechanisms of heterocyclic compounds. Illustrate different methods for the synthesis of 5- and 6-membered heterocyclic compounds and summarise their properties, and biological importance.
			CO6	Distinguish and characterize various classes of natural products by their structures. Identify pharmaceutically active products of natural origin.
VI	CHEM6BOPCF	Chemistry 7	CO1	Understand complex biochemical pathways within living cells. Elaborate the importance of ATP.
			CO2	Solution to various disorders caused due to impairment of various metabolic pathways in the living system.
			CO3	Discuss the role of active methylene compounds in various organic syntheses, illustrate the mechanisms involved and propose the synthesis. Identify the importance of coupling reaction in dye industry. Apply organometallics in synthetic organic chemistry

			CO4	Understand and compare the principle and theory of various spectroscopic techniques. Determine the effect of conjugation on UV-Visible absorption spectrum. Interpret the spectra of compounds, determine functional groups and propose structures for compounds. Apply the knowledge in the characterisation of organic compounds in research and chemical industry.
			CO5	Explain the principle of Raman and ESR spectroscopy and their application to simple molecules
			CO6	Understand the working principle, experimentation and applications of Fluorescence Spectrometry, GC, HPLC, ion-exchange chromatography, CV, and thermogravimetric analysis
VI	CHEM6EPCF	Chemistry 8	CO1	Understand the basic principles of pharmacology, pharmacodynamics and pharmacokinetics. Outline the various stages and practical application of pharmacokinetics . Describe the various phases of clinical studies. Explain the rationale for the complete development plan (pharmaceutical, pre-clinical and clinical) according to the proposed therapeutic indication
			CO2	Relate the concepts of active principles and lead compounds in drug discovery; Outline and critically appraise the principal steps in drug discovery Describe the technologies available and those in development of new drugs; Explore the therapeutic opportunities that might arise from the technology(gene therapy)

			CO3	Apply the concepts of enzyme inhibition, drug-receptor interaction, working of proton pumps and ion channel pathways in drug action with suitable illustrations. Relate the factors that modify the effect of drug action. Distinguish drug potency and efficacy. Construct dose-response curves to predict the safety margin of the drug
			CO4	Outline the process of drug development and identify the critical factors and decision points in QSAR approach. Evaluate the advantages of combinatorial organic synthesis in scaling up production of drugs to meet increasing demand
			CO5	Categorise the drugs based on pharmacological-application and interpret their mode of action with suitable illustration. Understand and compare the mechanism of action of each class of drug; relate drug-drug interaction and its impact in patient safety
			CO6	Apply the basic concepts of buffers, acid-base theories and Henderson's equations in buffer preparations and evaluating their functions in pharmacy. Develop analytical skills in predicting the buffer concentrations and develop practical skills in preparing buffers required for an assay of drug. Assess the use of antioxidants in pharmacy. Discuss the role of radio pharmaceuticals in drug industry. Create an awareness about the factors involved in quality control of drugs.
	CHEM6EECF	Chemistry 8	CO1	Understand the concept and importance of entrepreneurship and entrepreneur in relation to the characteristics, functions, challenges and types of entrepreneurs.
			CO2	Outline the functioning of the cosmetic industry in terms of raw materials used, Indian standard specifications for production, formulation of cosmetics and quality assurance.

			CO3	Evaluate the nutritional requirements for different age groups, sex, and health conditions through understanding the concept of nutritional value. Explain food production in terms of processing, preservation, additives, qualitative analysis and adulteration.
			CO4	Evaluate the importance of the given soil / water / plant through analysis of the physical and chemical properties of the given soil / water and plants.
			CO5	Understand the drugs in terms of WHO definition, nomenclature, dosage forms, formulations, quality analysis, adulteration and toxicology.
			CO6	Describe the importance of nanomaterials for various applications in daily life, based their properties of various nanomaterials
			CO7	Mention the salient features of various rules and acts related to food, cosmetics and drug
	BOTANY			
	PO Code	Programme Outcomes		
	PO1	To understand and appreciate the diversity of Flora.		
	PO2	To gain knowledge of simplest to most complex plant forms		
	PO3	To provide baseline information on applied aspects of botany		
	PO4	To foster interaction of students regarding conservation of endemic plants		
Semester	CourseCode	CourseName	CO Code	Course Outcomes
			CO1	

I	BOT1DNP1A	Diversity of Non Vascular plants Part I		To know about the microbial diversity and to understand the fundamental functioning of primitive cells.
			CO2	To understand the bacterial structure and the diseases caused by them in plants.
			CO3	To understand the bacterial structure and the diseases caused by them in plants.
			CO4	The study of the simplest aquatic plant classifications.
			CO5	Study the primitive algal forms in detail.
II	BOT2DNVPA	Diversity of Non Vascular plants part II and Plant Anatomy	CO1	This paper emphasizes on fungi which is a very important group of plants as many of them are economically important.
			CO2	As productivity and control of diseases is a major concern, this paper highlights the importance of VAM, nematophagous fungi, and lichens in the improved growth of plants.
			CO3	Students are made aware of some of the common diseases and their control using biofertilizers.
			CO4	The study of Bryophyta helps the students to understand the process of evolution of these plants from Thallophyta.
			CO5	This paper helps to study tissues and tissue organization in plant kingdom.
III	BOT3DVPEA	Paper 3- Diversity Of Vascular Plants and Ecology	CO1	The students will be able to learn about the general characters of Pteridophytes and the life cycle of different classes of Pteridophyte with specific examples and the role of these plants in evolution to show better advanced characters.
			CO2	The students will be able to learn about the general characters of Gymnosperms and the life cycle of different classes of gymnosperms with specific examples and the role of these plants in evolution.

			CO3	The students will learn about plant fossils, types and the process of their formation, geological time scale to understand the evolutionary process and its application in exploration of fossil fuels.
			CO4	The students will learn about the various ecological factors and the interaction of biotic and abiotic factors. They will also understand the concept of ecosystems and conservation and its application in conserving the ecosystem with insitu and exsitu conservation methods.
			CO5	The students will learn about the phytogeographical diversity of India and also in detailed about Karnataka and the application of remote sensing in mapping the vegetation.
IV	BOT4CMB	Cytogenetics and Molecular Biology	CO 1	To understand the life processes at sub-cellular and molecular level
			CO 2	To understand the principles of inheritance at individual and population level
			CO 3	To understand the significant theories of evolution and its historical progress through ages
			CO 4	To understand and apply the principles and techniques of molecular biology
V	BOT5PPA	Plant Physiology	CO1	The student will be able to analyze the mechanism by which plants are taking up water and minerals and using it for their nutrition.
			CO2	2. The students will gain knowledge about photosynthesis which is the process by which plants prepares food in the presence of light.
			CO3	3. The student will get to know how the plants translocate the food that is prepared primarily in the leaves to the different parts of the plant.
			CO4	4. The student will be able to appreciate the different types of respiration happening in plants.
			CO5	5. The student will understand the importance of the role of different

				plant growth regulators and their mode of action in plants.
			CO6	6. The student will be able to distinguish between the different plant movements.
	BOT5TEBLA	Paper 5: Taxonomy, Economic Botany, Embryology of Angiosperms	CO 1	Understand the basic concept of Taxonomy
			CO 2	Gain knowledge and information on different types of inflorescence and fruits
			CO 3	Help the students to appreciate the economic value of plants
			CO 4	Understand the characteristic features of families to which the plant belongs
			CO 5	Understand the concept of developmental and experimental biology
VI	BOT6BTABA	Paper 7 : Biotechnology and Applied Botany	CO1	Exposure to industrial biotechnology and Students can come out with entrepreneurship based techniques
			CO2	Exposed to environmental awareness
			CO 3	Able to learn the plant tissue culture techniques
			CO 4	Awareness about the medicinal plants
			CO 5	Knowledge about agricultural and horticultural crops
	BOT6EATA	Paper 8: Elective: Advanced Taxonomy	CO1	The student will gain competence in identification of plants.
			CO2	The student realizes the importance of herbarium technique.
			CO3	The students will be able to connect other branches of botany in solving taxonomic problems.
			CO4	The students will be able to appreciate the importance of plants for mankind.
			CO5	The students will be able to understand the concept of ethnobotany.
			CO6	The student gains knowledge about the different systems of classification of angiosperms and its evolution

			CO7	The student will be able to appreciate the role of botanical garden in taxonomy.
	BOT6EAPA	Paper 8: Elective: Advanced Physiology	CO1	Gain knowledge on the structure and functions of cell organelles
			CO2	Analyze the bacterial photosynthesis and respiration
			CO3	Understand the working and applications of various modern techniques
			CO4	Will be able to understand the enzyme mechanism and purification of enzymes
			CO5	Understands the concepts of physiological mechanism of plants to different stresses
			CO6	Apply end to end applications and significance of hydroponics and aeroponics
	MICROBIOLOGY			
	PO Code	Programme Outcomes		
	PO1	Students will be able to acquire, articulate, retain and apply specialized skills and knowledge relevant to microbiology.		
	PO2	Students will be able to appreciate the diversity of microorganism and microbial communities inhabiting a multitude of habitats, understand their pathogenic as well beneficial significance to man and nature.		
Semester	CourseCode	CourseName	CO Code	Course Outcomes
I	MIC1FMA	Fundamentals of Microbiology	CO1	To understand history, relevance of microbiology and classification of bacteria
			CO2	To understand the working of various microscopes and their application

			CO3	To gain knowledge of various (physical and chemical) methods of control of microorganisms and safety measures to be followed while handling microbes
			CO4	To understand the structure of bacterial cells, its organelles, physiology and behavior
			CO5	To learn different methods of staining bacteria
			CO6	To demonstrate proficiency in handling aseptic bacteriological specimens
II	MIC2MDGCA	Microbial Diversity, Growth and Culturing	CO1	To demonstrate an understanding of bacterial, fungal, cyanobacterial, viral and rickettsial classifications, culturing, reproduction and significance.
			CO2	The student will learn the techniques of studying bacterial growth curve and factors effecting growth curve.
			CO3	The students will gain knowledge about role of macronutrients and micronutrients in growth of microbes.
			CO4	The student will gain competence to understand anaerobic cultivation of microorganisms.
			CO5	The students will be able to realize the importance of national and international microbial culture collection centres.
			CO6	The student will know general bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae.
			CO7	The student will master aseptic techniques and be able to perform routine culture handling tasks safely and effectively.
III	MIC3BBMA	Biophysics, Biochemistry and Microbial Physiology	CO1	To understand the scope of biophysics, principle, construction working of spectrophotometers, centrifuges, column chromatography.
			CO2	The student is able to describe the concept of, pH and its biological significance, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.

			CO3	The student develops understanding of the laws of thermodynamics, concepts of entropy, enthalpy and free energy changes and their application to biological systems and various biochemical studies and reactions.
			CO4	Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation.
			CO5	Overview of major biomolecules: Classification, structure, function of carbohydrates, lipids, proteins, amino acids, nucleic acids.
			CO6	Discuss the biosynthesis and the degradation pathways involved in the physiology of microbes.
			CO7	Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, application of enzymes in large scale industrial processes.
IV	MIC4MMRA	Microbial Genetics, Molecular Biology, Recombinant DNA Technology	CO1	The students will be able to understand how DNA replication and recombination occurs in bacteria
			CO2	The students will be able to understand the concept of gene expression, gene regulation, mutations and DNA repair in prokaryotes
			CO3	The students will be able to know the importance E. coli and Pichia pastoris as model organisms
			CO4	The students will be able to analyze the role of various enzymes, vectors and other tools used in genetic engineering
			CO5	The students will be able to apply the knowledge of recombinant DNA technology to create novel products
			CO6	The students will be able to discuss various methods of introducing DNA into cells and how to screen and select the recombinants

V	MIC5IMB	Immunology and Medical Microbiology	CO1	The students will be able to identify the cellular and molecular basis of immune responsiveness
			CO2	The students will be able to describe the roles of the immune system in both maintaining health and contributing to disease
			CO3	The students will be able to describe immunological response and how it is triggered and regulated
			CO4	Explain interventions employed to prevent infectious diseases including infection control measure and vaccines
			CO5	Identify common infectious agents and the diseases that they cause and their relevance to healthcare and the pharmaceutical industry
			CO6	Assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance
			CO7	It also provides opportunities to develop diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases
			CO8	The student will be able to describe the epidemiology of infectious agents including how infectious diseases are transmitted
	MIC5BFDMA	Biostatistics, Food and Dairy Microbiology	CO1	To understand the significance and activities of microorganisms in food and role of intrinsic and extrinsic factors on growth and survival of microorganisms in food and dairy.
			CO2	To know the spoilage mechanisms in foods and dairy and thus identify methods to control deterioration and spoilage
			CO3	To recognize and describe the characteristics of important pathogens and spoilage microorganisms in foods and dairy.
			CO4	To learn various methods for their isolation, detection and identification of microorganisms in food and dairy and employ in industries

			CO5	To identify ways to control microorganisms in food and dairy and thus know the principles involving various methods of food preservation
			CO6	To understand of the basis of food safety regulations and discuss the rationale for the use of standard methods and procedures for the microbiological analysis of food and dairy.
			CO7	To acquire, discover, and apply the theories and principles of food microbiology in practical, real-world situations and problems.
			CO8	To demonstrate skills in interpreting and communicating the results of statistical analysis in writing
			CO9	To learn to participate in a research team setting in study design, data coordination and management, and statistical analysis of study results.
VI	MIC6IMBA	Industrial Microbiology and Bioinformatics	CO1	To get acquainted with the industrial aspect of the field of Microbiology, and also learn about growth pattern of microbes in different industrial systems.
			CO2	To learn the techniques of discovering (new) useful microorganisms by various isolation, screening and strain improvement methods and store them reliably for later use.
			CO3	To develop understanding of various upstream processes like media formulation, sterilization, process control and selection of the appropriate fermentation process.
			CO4	To develop understanding of functional and fabrication aspects of various bioreactor designs.
			CO5	To gain knowledge about microbial production of various industrial products such as alcohols, Vitamines, enzymes, organic acids, Antibiotics, biofertilizers, biopesticides, vaccines and biofuel etc.

			CO6	Develop an understanding of downstream processes like detection and assay of the product, methods of recovery of the product and purification of the production.
			CO7	The students will be able to describe the contents and properties of the most important bioinformatics databases, perform text- and sequence-based searches, and analyze and discuss the results in light of molecular biological knowledge
	MIC6EMEB	Elective 1 - Microbial Ecology	CO1	To elaborate on the positive and negative interactions of microorganisms in the soil
			CO2	To value the role of microbes in: biogeochemical cycles, bioleaching, biodegradation, as biopesticides and biofertilizers
			CO3	To understand how microorganisms can cause diseases in plants, and to formulate different measures to prevent and treat these diseases
			CO4	To understand how to isolate and identify microorganisms from the various water sources to check the potability of water
			CO5	To explain the different treatment methods for sewage water
			CO6	To isolate and identify air-borne microorganisms and deduce their role in respiratory disorders
			CO7	To analyze the importance of biosafety cabinets for aseptic procedures
	MIC6ECMA	Elective 2 - Clinical Microbiology	CO1	The students will be able to identify Infections caused by pathogenic bacteria and select the best methods for their diagnosis in the clinical laboratory
			CO2	The students will be able to critically analyze the results of clinical investigations
			CO3	The students will be able to explain interventions employed to prevent infectious diseases including infection control measure and vaccines

			CO4	The students will be able to assess treatment strategies including the appropriate use of antimicrobial agents and common mechanisms of antimicrobial action and resistance
			CO5	It also provides opportunities to develop diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases
			CO6	The student will be able to communicate using the proper scientific language of the field including clinical laboratory reports written with a professional approach
			CO7	The students will be able to Apply theory, microbiology knowledge and technical skills to identify bacteria, fungi and parasites in the laboratory, appreciating the hazards associated with handling microorganisms in the laboratory and the subsequent safety