Deccan Education Society's

Fergusson College (Autonomous), Pune

Program Specific Outcomes(PSOs) and Course Outcomes (COs) 2019-20

Department of Chemistry

Programme: M.Sc. Biochemistry

PSO No.	Program Specific Outcomes(PSOs) Upon completion of this programme the student will be able to
PSO1	**Academic competence:** (i) Articulate fundamental concepts, principles and processes underlying the field of biochemistry and its different branches (ranging from biomolecules, metabolism, nutrition, cell biology, genetics, enzymology, immunology, physiology, endocrinology, plant biochemistry, molecular biology to genetic engineering, neurochemistry) and its linkage with related disciplinary areas/subjects. (ii) Demonstrate an understanding and be able to explain a wide range of biochemical techniques (e.g. basic molecular biology, genetic engineering, microbiology methods, spectrophotometry, enzyme kinetics, chromatography, electrophoresis, immunological assays)
PSO2	**Personal and Professional Competence:** (i) Execute critical thinking and be capable in experimental data interpretation and carry out laboratory-orientated numerical calculations. (ii) Identify biochemistry related problems and use appropriate concepts and methods to solve them. (iii) Formulate scientific protocols, write authentic reports and develop effective presentation and conversational competence.
PSO3	**Research Competence:** (i) Review scientific literature, develop a hypothesis and formulate scientific protocols and conduct appropriate experiments. (ii) Plan and execute research projects professionally while emphasizing on academic and research ethics, scientific misconduct and creating awareness about intellectual property rights and issues of plagiarism (iii) Integrate informatics and statistical skills to explore and authenticate biological data for experimental and research purpose
PSO4	**Entrepreneurial and Social competence:** (i) Develop solutions and apply appropriate techniques towards specific areas related to biochemistry including industrial production, clinical, health, agriculture. (ii) Execute social competence including listening, speaking, observational, effective interactive skills and presenting skills to meet global competencies.

F.Y. M.Sc. Semester I		
Title of the Course and Course Code	**Biomolecules (CHB4101)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall source, structures and list the significance of biomolecules.	1
CO2	Classify biomolecules with suitable examples and differentiate between their features.	2
CO3	Apply the knowledge of membrane composition to corelate with its properties and different types of transport mechanisms.	3
CO4	Analyze the interrelationship between biomolecules and their derivatives. Identify the sequence of steps required to determine hierarchy in the structural organization of macromolecules.	4
CO5	Evaluate in-vitro and in-vivo reactions of biomolecules along with their significance.	5
CO6	Assemble and tabulate the coenzymes of vitamins and corelate its significance in biochemical reactions. Plan the use of suitable methodologies for characterization of biomolecules.	6
Title of the Course and Course Code	**Genetics and Cell Biology (CHB4102)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall the basic concepts and theories related to genetics and cell biology. Describe mendelian principles and its extensions.	1
CO2	Articulate the types of mutations, causes and classify them. Interpret the reasons behind sex determination and discuss types of inheritance. Explain genetic complementation test and its uses	2
CO3	Apply the principles of genetics to solve the problems. Illustrate different methods of horizontal gene transfer in bacteria.	3
CO4	Compare prokaryotic and eukaryotic cells and explain about subcellular organelles and their functions.	4
CO5	Review the process of gametogenesis, fertilization, organogenesis and importance of stem cells and types. Compare different types of transport mechanisms across cell membrane.	5
CO6	Rearrange the processes and cyclic events of cell division and describe cellular aging and cell death. Integrate the subject knowledge to write and present the scientific topics and research articles.	6

Title of the Course and Course Code	**Biophysical Techniques (CHB4103)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall basic concepts of separation and purification techniques along with their applications.	1
CO2	Articulate concepts, parameters, mechanism and applications of different types of chromatography.	2
CO3	Illustrate the types of electrophoresis, applications and principles underlying the techniques. Apply the knowledge for biomolecules separation.	3
CO4	Identify sedimentation techniques, applications and the factors affecting sedimentation velocity and coefficient.	4
CO5	Review concepts of radioactivity, tracer techniques and radioactive detecting/measuring instruments. Evaluate the separation techniques for biomolecules.	5
CO6	Specify the working mechanisms and applications of basic spectroscopic techniques. Compile methods to separate biomolecules and present the subject relevant topics/ research articles.	6
Title of the Course and Course Code	**Enzymology and Plant Biochemistry (CHB4104)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe basic concepts of biocatalyst (Enzyme) and plant biochemistry. Recall general characteristics of enzymes and outline plant processes	1
CO2	Discuss the molecular arrangements of enzymes, interaction behaviour and mechanism of action. Explain enzyme kinetics and processes of plant biochemistry	2
CO3	Demonstrate characteristics and potential of enzymes. Generalize the methods of isolation and purification of plant molecules and enzymes.	3
CO4	Compare the processes, applications of enzymes and plants molecules. Organize information about enzymes and attribute the role towards specific functions.	4
CO5	Evaluate the outcomes of the enzymatic reactions and plant biochemical studies.	5
CO6	Specify the role, function and metabolism of different components and processes in plants. Design a method to study enzymes and plant molecules.	6

Title of the Course and Course Code	**Biochemistry practical I (Analytical Biochemistry) (CHB4105)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall and tabulate the reactions of biomolecules.	1
CO2	Infer color tests and give examples of compounds and differentiate with their properties.	2
CO3	Apply the knowledge to identify and estimate concentration of unknown compounds. Demonstrate methods to study and compare different techniques for qualitative and quantitative analysis.	3
CO4	Organize, tabulate and represent information and studies with proper understanding.	4
CO5	Select the exact techniques for estimation of unknown compounds. Judge the outcomes of color tests and readings.	5
CO6	Design a method to study a particular biomolecule and develop a protocol to isolate and purify it.	6
Title of the Course and Course Code	**Practical Course II (Enzymology and Biophysical Techniques) (CHB4106)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe the principle, mechanism and role of reagents used in enzymology and biophysical techniques experiments.	1
CO2	Estimate enzyme activity and predict the effect of various factors, activators and inhibitor on it. Articulate chemistry and state of amino acids.	2
CO3	Carry out isolation, purification and detection of enzymes from different sources. Calculate the concentration of solutions.	3
CO4	Demonstrate basic techniques like electrophoresis, chromatography, dialysis for identification and separation of biomolecules. Analyse the properties of amino acids and proteins.	4
CO5	Decide the absorption maxima and measure the absorbance of the reactions using UV spectrophotometers.	5
CO6	Plan an experiment, interpret and conclude its results. Prepare solutions of a given pH and concentration.	6

F.Y. M.Sc. Semester II		
Title of the Course and Course Code	**Microbiology and Fermentation technology (CHB4201)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe different types of microscopes, characteristics of different microorganisms, their structures and different sterilization techniques.	1
CO2	Explain the effects of different physical and chemical agents on growth of microorganism.	2
CO3	Predict and compare the types of plant and animal viruses along with their characteristics. Relate the role of microorganism in nitrogen metabolism.	3
CO4	Examine different types of fermentation process and its application in strain improvement and isolation of industrial important microorganisms. Explain the cultivation of microorganism and their pathogenicity.	4
CO5	Appraise the knowledge about production of enzymes, primary metabolites, antibiotics, pigments, sweeteners and beverages.	5
CO6	Specify the composition of different media and optimum conditions for their growth and applications of fermentation techniques.	6
Title of the Course and Course Code	**Metabolism (CHB4202)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall the structure of metabolic intermediates and names of enzymes.	1
CO2	Explain and illustrate the steps in biochemical pathways along with their regulations.	2
CO3	Apply knowledge of genetics and enzymology to understand the formation of specific intermediates in biochemical pathways and inborn errors of metabolism.	3
CO4	Classify the types of metabolic reactions and outline the concepts of bioenergetics.	4
CO5	Justify varied conditions required for the occurrence of desired metabolic reactions.	5
CO6	Rearrange and write the correct sequence of fates of metabolic products based on the specified physiological conditions.	6

Title of the Course and Course Code	**Molecular Biology (CHB4203)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe the general properties of viral, prokaryotic and eukaryotic genomes, structural organization of chromosomes and recall basic concepts related to molecular biology.	1
CO2	Explain the molecular mechanism of replication, DNA repair, transcription, translation and related molecular processes in prokaryotes and eukaryotes.	2
CO3	Apply fundamental understanding of molecular biology to predict the role of different inhibitors, proteins, enzymes involved in processes. Outline the molecular biology concepts and illustrate the processes.	3
CO4	Analyse molecular events in prokaryotic and eukaryotic organisms and compare them. Identify events involved in RNA processing and regulation of gene expressions in prokaryotes and eukaryotes.	4
CO5	Justify and review the molecular processes in prokaryotes and eukaryotes. Summarize post-translational modification events and protein targeting mechanisms.	5
CO6	Compile the molecular processes in prokaryotes and eukaryotes and specify gene regulation mechanism. Review and prepare a summary of scientific topics/papers related to subject and professionally present literature articles.	6
Title of the Course and Course Code	**Physiological Biochemistry (CHB4204)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall the terminologies, location, and functions of human body parts. Describe in detail physiology and anatomy with special functions.	1
CO2	Discuss the working mechanism, conditions, processes of different organs and regulation with respect to functioning of other organs. Implement clinical data in normal and disease conditions of specific organs.	2
CO3	Demonstrate the working and processes in body parts at new or different situations. Apply the knowledge to identify the situation with biochemical parameters and execute methods to study clinical prospective.	3
CO4	Identify processes with respect to physiology and anatomy of the organs. Explain the effects and role of molecules in different tissues and cells with respect to specific function.	4
CO5	Judge the symptoms, implement exact techniques used in study and diagnosis of diseases and describe the path.	5
CO6	Develop the skill to read, understand diagnostic reports and identify	6

	the future process.	
Title of the Course and Course Code	**Practical Course III (Microbiology and Special Experiments) (CHB4207)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall different types of sterilization techniques and its importance for cultivation and preservation of microorganisms.	1
CO2	Predict the effect of U.V. radiations on growth of microorganisms and study growth curve. Articulate different techniques for isolation of microorganisms and describe the concept of BOD and COD.	2
CO3	Use different techniques to isolate microorganism and demonstrate antibiotic sensitivity assay. Execute methods to study and compare the adulteration and pasteurization in milk samples.	3
CO4	Analyse the basic phytochemicals present in plants with their role and identify them by performing qualitative and quantitative tests.	4
CO5	Evaluate activities of enzymes from different sources.	5
CO6	Perform experiments for isolation and characterization of microorganisms, proteins and other biomolecules from natural sources.	6
Title of the Course and Course Code	**Practical Course IV (Clinical Biochemistry and Basics of Cell Culture) (CHB4208)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall the basic aspects of clinical biochemistry and cell culture. Describe physiology and anatomy of organs with their special functions.	1
CO2	Discuss different principles behind clinical biochemistry experiments and animal cell culture techniques.	2
CO3	Carry out the experiments and interpret the results. Calculate cell count and predict the viability.	3
CO4	Analyse the experimental data and relate it with clinical parameters.	4
CO5	Compare the experimental values with normal values and justify the deviations. Review basics of cell culture, its importance and perform tasks relevant to cell culture.	5
CO6	Plan and perform experiments related to clinical biochemistry and animal cell culture techniques .	6

S.Y. M.Sc. Semester III		
Title of the Course and Course Code	**Genetic Engineering and Animal Cell Culture (CHB5301)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe basic concepts of genetic engineering and animal cell culture. Recall role of enzymes, vectors, host and types of modification techniques.	1
CO2	Explain the transformation techniques and predict suitable methods for identification and selection of transformed cells. Outline cloning strategies and compare different vectors and hosts for expression of foreign genes.	2
CO3	Apply knowledge of genetic engineering and cell culture to prepare recombinant proteins, transgenic plants and animals.	3
CO4	Analyse DNA sequencing, DNA profiling, nucleic acid amplification and protein engineering techniques along with their applications.	4
CO5	Review different gene editing tools, biological assays, types of tissue culture and their applications.	5
CO6	Design the process for gene cloning and producing recombinant proteins in suitable hosts. Specify the types and techniques of animal cell culture. Prepare a written and oral presentation of scientific topics and research papers related to genetic engineering and animal cell culture.	6
Title of the Course and Course Code	**Immunology and Toxicology (CHB5302)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe the terminologies, different cell and organs involved in immunology and cite the types of immunity. Recall theory behind production of antibodies and reproduce the structure for different types of MHC molecules and antibodies.	1
CO2	Discuss the principle, procedure and applications of different techniques involving antigen-antibodies reactions.	2
CO3	Classify the concept of the complement system, hypersensitivity and its reaction, ABO blood group system, immunization and vaccine types.	3
CO4	Explain different areas and applications of toxicology, doses responsible for toxicity, its risk and safety measures.	4

CO5	Evaluate the interaction of chemicals dose response, its selectivity with animals and justify descriptive animal toxicity test. Determine the effect of mutagenesis on genetic toxicity, teratology and reproduction.	5
CO6	Arrange different biotransformation reactions with their phases, detoxication and toxication reactions and its effect on body mechanism. Specify the role of Cytochrome P-450 monooxygenase system.	6
Title of the Course and Course Code	**Neurochemistry and Endocrinology (CHB5303)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall anatomical parts of the nervous system with their significance and list out types of bio signalling molecules.	1
CO2	Explain the working mechanism of the central and peripheral nervous system. Infer the knowledge of neurotransmission to correlate the sequence of biochemical processes.	2
CO3	Classify hormones based on different criteria and explain the steps involved in their biosynthesis. Identify the desired regulatory biofunctions of hormones as per the requirement of the cell and outline their mechanism of action.	3
CO4	Distinguish the role of biosignaling molecules in maintaining homeostasis at different physiological conditions.	4
CO5	Determine the disorders that arise due to abnormalities in secretion and functioning of hormones, neurotransmitters and justify the need to evaluate the disease conditions.	5
CO6	Prepare a chart for the necessary changes in lifestyle that can help to manage hormonal and neurological disorders.	6
Title of the Course and Course Code	**Biostatistics, Bioinformatics and Advance Biophysical Techniques (CHB5304)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Define the most common measures of central tendency, linear regression and probability.	1
CO2	Articulate normal distribution and its relationship with binomial distribution, the usefulness of significance testing and apply basic statistics to solve biochemical problems. Estimate errors in a scatter plot with a regression line.	2
CO3	Classify different types of Biological databases and structure prediction methods. Use the basics of sequence alignment for analysis. Compute the statistical problems.	3
CO4	Explain the theory, principle, applications of different spectroscopic techniques along with instrumentation and select appropriate method for analysis and characterization of biomolecules.	4
CO5	Compare the types of biosensors and explain working principle and applications.	5

CO6	Specify the operation, instrumentation, uses of scanning and transmission electron microscopy and apply the knowledge to characterize the molecule.	6
Title of the Course and Course Code	**Nutraceuticals, Pharmaceuticals and Molecular Oncology (CHB5305)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall basic terms related to pharmaceuticals and medicine in the form of food, and genetics behind cancer	1
CO2	Understand the sources, structure and properties nutraceuticals and pharmaceuticals and their target cell identification with mode of action in normal and cancer cell	2
CO3	Demonstrate the interaction of molecules, responses and metabolism Predict the effects and working in normal and disease condition	3
CO4	Compare different types of pharmaceuticals and nutraceuticals and their role in cancer treatments	4
CO5	Select proper molecule in disease management and define its role	5
CO6	Formulate the new molecule and design further research in cancer and other diseases.	6
Title of the Course and Course Code	**Clinical Nutrition & Food Technology (CHB5306)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall basic terms related to nutrition and habits for food.	1
CO2	Understand the types of food, composition and benefit of its nutrients in normal and disease condition.	2
CO3	Demonstrate the role various molecules of food in different stages of life. Explain the use of technology in day today food utility	3
CO4	Compare the food therapies for various inborn errors and more related diseases. Examine food qualities using various techniques and differentiate between toxins and normal food	4
CO5	Choose method to analyse food and characterise it	5
CO6	Design diet plan and decide technique for food analysis	6

Title of the Course and Course Code	**Biochemistry Practical V (Molecular Biology and Immunology) (CHB5307)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe the principle, mechanism and role of reagents used in molecular biology and immunology experiments.	1
CO2	Explain the basic theory behind isolation of nucleic acids. Estimate the nucleic acid concentration and infer the purity level.	2
CO3	Carry out nucleic acid isolation from various sources and demonstrate bacterial transformation.	3
CO4	Differentiate between theory and steps involved in restriction digestion and ligation reaction. Compare the mechanism of PCR, real-time PCR and analyse its data.	4
CO5	Review the principle of antigen antibody reaction and justify different immunodiffusion patterns.	5
CO6	Perform different tests demonstrating immunological reactions and explain the mechanism.	6
Title of the Course and Course Code	**Biochemistry Practical-VI (Bioinformatics, Computer Skills and Statistical Analysis) (CHB5308)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Recall basic concepts in recording experimental data in required format and use biological software tools to represent it.	1
CO2	Compute the experimental data using different computer skills and translate it to interpret the results.	2
CO3	Use information and apply respective tools of statistics using software and define the tasks.	3
CO4	Compare sequence and statistical data, execute programs to generate results, compare output and demonstrate data.	4
CO5	Judge and select the correct piece of information from output and compare results.	5
CO6	Formulate the new component from data and translate information from one form into another form. . Specify all levels of the program and apply knowledge to operate it.	6

S. Y. M. Sc. Semester IV		
Title of the Course and Course Code	**Biochemistry Project (CHB5401)**	**Number of Credits : 04**
On completion of the course, the students will be able to:		**Bloom's Cognitive level**
CO1	Describe the rationale behind the project work and show a sound knowledge of the selected topic.	1
CO2	Outline experimental design and articulate appropriate methods to achieve the stated objectives of the project.	2
CO3	Carry out literature survey, experiments; interpret and examine the findings of the experiments.	3
CO4	Compare, criticize and relate the obtained results to the scientific evidence and discuss it.	4
CO5	Determine the applications of projects and future aspects.	5
CO6	Prepare a formal project report in the form of a dissertation and research articles. Develop an ability to communicate effectively orally and in writing and defend their research work to a panel of experts.	6