MAR ATHANASIOS COLLEGE FOR ADVANCED STUDIES TIRUVALLA

(MACFAST)

Programme and Course Outcomes for All Programmes

MAR ATHANASIOS COLLEGE FOR ADVANCED STUDIES TIRUVALLA (MACFAST)

Tiruvalla, Pathanamthitta, Kerala 689 101

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME OUTCOMES (POS)

MASTER OF COMPUTER APPLICATIONS

At the end of the MCA Programme, graduating students/graduates will be able to:

- **PO1 : Communicate Effectively:**
  Inculcate effective communication skills combined with professional & ethical attitude with the computing community and also the society by comprehending and writing effective reports and documentation, making effective presentations and providing and receiving clear instructions.
- **PO2 : Computational Knowledge:**
  Relate and apply fundamental knowledge of computing technology and relevant domains for the conceptualization of models from defined problems, appropriate to the discipline.
- **PO3 : Design and Development of Solution:**
  Design, implement and evaluate complex business scenarios and contemporary issues into desired need based solutions with a passion for quality, competency and holistic approach.
- **PO4 : Solving Complex Computing Problems:**
  Use problem solving and analytical skills including design of experiments, analysis and interpretation of information and synthesis of knowledge to unravel multifaceted industrial problems.
- **PO5 : Lifelong Learning:**
  Engage in continuous learning as an expert by applying latest knowledge and methodologies to design, analyze and interpret data for finding solutions for complex problems by applying modem technological tools.
- **PO6 : Social, Cultural, Environmental, Legal and Ethical Concern(s):**
  Recognize environmental, social, cultural, legal, ethical and cyber issues involved in the use of technology and other consequential responsibilities relevant to professional practice with an understanding of the cyber space.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1: Prepare foundations of mathematics, computer science and problem solving methodologies for effective implementation in real life applications.

PSO2: Facilitate students to explore the principles of Software Engineering with appropriate data modeling concepts and latest technologies.

PSO3: Use of recent technologies, skills and knowledge for the design and development of applications in the computing discipline.

PSO4: Inculcate employability skills among students who can contribute innovative and advanced solutions for the important life problems.

PSO5: Interpret the concepts of Network and communication technologies, social network and other related aspects.

PSO6: Comprehend and apply IT concepts to manage projects in a multidisciplinary environment.

COURSE OUTCOMES (COS)

MASTER OF COMPUTER APPLICATIONS REGULAR [2 YEARS]

First Semester	
Course	**Outcomes**
MCA CT 101 Mathematical & Statistical foundation for Computer Applications	CO 1 - Defining sets , relations, functions - K1 CO 2 – acting out the Rules of inference to solve applied problems.- K3 CO 3 – Defining regression and correlation– K1 CO 4 – Defining probability theory- K1 CO 5- Examining different probability distributions and sampling techniques- K3 CO 6 – Defining the methods for Testing hypothesis – K1
MCA CT 102 Digital Logic & Computer Organization	CO 1 – Introduce the concepts of binary arithmetic and computer codes – K1 CO 2 – Understand the basics of Boolean algebra and familiarize the digital circuits – K2 CO 3 – Present knowledge in basics of computer organisation – K3 CO 4 – Express the concepts of memory and input-output organization – K2 CO 5 – Presenting the concepts of advanced computer architecture - K3
MCA CT 103 Structured programming in C	CO 1 - Define The C Character Set, Identifiers data types K1 CO 2 – Identify operators, Type Conversion, Typedef- K1 CO 3 – Applying control and loop control statements - K2 CO 4 – Implementing functions and its operations- K2 CO 5 – Executing different operations on arrays, structures and union - K3 CO 6 – Demonstrating Pointers. Experiment file operations and bitwise operations. – K3
MCA CT 104 Software Engineering and Object Oriented Modeling	CO 1 - Define software and it's characteristics - K1 CO 2 - Gather software requirements - K2 CO 3 - Relate different Software Development Life Cycle models - K2 CO 4 - Interpret various software design strategies - K2

	CO 5 - Judge the suitable test strategies - K3 CO 6 - Identify various UML diagrams needed for software development - K1
MCA CT 105 Database Technology and NoSql	CO 1 – Introduce the basic concepts of a database system - K2 CO 2 – Introduce the basic concepts of a query language - K2 CO 3 – Implementing of the fundamentals of database system relational database systems including data models, database architectures, database manipulations and normalization. – K6 CO 4 – Illustrating the cases for database manipulations in distributed database, replication, fragmentation and NoSQL.– K4
MCA CP 106 Database Technology Lab (Mysql&Mongodb)	CO 1 – Experiment the general concepts of PHP scripting language for the development of Internet websites.- K5 CO 2 – Writing programs to solve various problems using MySQL database - K6 CO 3 – Interpret client side and the server side scripts - K2 CO 4 – Organize php programs into software development framework - K4 CO 5 – Outline php programs - K1 CO 6 – To understand the concepts of semantic web and web hosting - K2
MCA CP 107 Software Development Lab- I(C programming)	CO 1 - Experiment the implementation of various data types, operators, control statements and loops. - K5 CO 2 – Writing programs to solve various problems using functions - K6 CO 3 – Interpret Array concepts - K2 CO 4 –Implement programs using pointers - K4 CO 5 Build C programs using structures and data files– K6 CO 6 – Build a project using C concepts- K6

MCA CT 108 Employability Skill Training-Phase 1	CO 1- Assess the strength and weakness – K5 CO 2 – Estimate student's numerical ability, problem solving and mathematical skills-K3 CO 3 – Present effective resume and covering letter-K3 CO 4 – Examine sentences, grammar and phrases – K3
Second Semester	
Course	**Outcomes**
MCA CT 201 Optimization Techniques for Computer Applications	CO 1 - Defining operations research and various models in OR- K1 CO 2 – Executing simplex ,Big M ,dual- simplex method to solve LPP- K3 CO 3 – Examining problems of assignment and transportation – K3 CO 4 – Defining Game theory and Queuing Theory - K1 CO 5 – Explaining the basic applications of OR in Managerial Decision making - K1
MCA CT 202 Data structures and Algorithm Analysis	CO 1 – Understand data structures and analysis phase of algorithm- K1 CO 2 – Implement arrays, stacks,queues. - K2 CO 3 – Experiment linked lists, trees and graphs. - K3 CO 4 – Organize sorting techniques and hashing – K4 CO 5 - Judge the divide and conquer and greedy method- K3 CO 6 – Distinguish dynamic programming and backtracking concepts.- – K4
MCA CT 203 Computer Networking with TCP/IP	CO1 – Understand the functionality of a reference model for data communication – K1 CO 2 – Understand the various protocols of different layers – K1 CO 3 – Display expertise in the design and maintenance of individual networks – K3 CO 4 – Present advanced networking concepts for entry in advanced computer networking courses – K2 CO 5 – Understand the basic concepts of WWW and its protocols - K2
MCA CT 204 Data Science & Big Data Analysis	CO 1- Define Data mining and its concepts – K1 CO 2 –Examine the relationship between big data Analysis and Data Mining-K3

	CO 3 –Outline the Various Scientific Models in data science –K1 CO 4 –Summarize the scope and applications of Big Data – K2 CO 5 –Present the various modules in big data-K3
MCA CP 205 Object oriented Lab(Java Lab)	CO 1 - Experiment the implementation of various OOP concepts - K5 CO 2 – Writing programs to solve various problems using OOP Concepts - K6 CO 3 – Interpret various OOP concepts - K2 CO 4 – Organize Java programs into conceptual elements - K4 CO 5 – Outline java programs - K1 CO 6 – Compare various programming language constructs - K2
MCA 206 CP Software development lab-II (PHP)	CO 1 – Introduce the basic concepts of a database system - K2 CO 2 – Introduce the basic concepts of a query language - K2 CO 3 – Implementing of the fundamentals of database system relational database systems including data models, database architectures, database manipulations and normalization. – K6 CO 4 – Illustrating the cases for database manipulations in distributed database, replication, fragmentation and NoSQL.– K4
MCA 207 CP Data structures Lab using C	CO 1 - Experiment the implementation of polynomial addition, stacks, infix to postfix expression. - K5 CO 2 – Experiment the implementation of linear queue and circular queue e- K5 CO 3 – Implementation of linked list and linked stack – K4 CO 4 – Creation of a doubly linked list binary tree and binary search tree and performing the traversals.- K6 CO 5 - Build programs using linear search and binary search– K5 CO 6 – Demonstrate various sort algorithms – insertion sort, merge sort, quick sort and heap sort - K6

Third Semester	
Course	**Outcomes**
MCA CT 301 Machine Learning Techniques	The course aims to : ● To introduce students to the basic concepts and techniques of Machine Learning. ● To develop skills of using recent machine learning software for solving practical problems. ● To gain experience of doing independent study and research.
MCA CT 302 Cyber Forensics	The course aims to : ● To provide an understanding of computer forensics fundamentals. ● To analyze various computer forensics technologies. Enable students to understand, explore and acquire a critical understanding in Cyber crimes and Cyber Law.
MCA 303_ET1 Artificial Intelligence	The course aims to : ● Get insights into the basic knowledge of Artificial Intelligence, AI application along with its importance. ● Be familiar with problem representation in symbolic notation. ● Able to understand the algorithmic approach in machine learning and automation ● Analyze the matching techniques for organizing and manipulating knowledge. Predict pattern based on Reasoning. ● Acquire basic knowledge in various fields of AI.
MCA 303_ET2 Enterprise Resource Planning	The course aims to : ● Get insights into the basic knowledge of ERP and its application along with its importance. ● Be familiar with ERP functions. ● Able to understand the working of ERP system ● Analyze the various ERP solutions

MCA 303_ET3 Computer Graphics and Multimedia	● To introduce the use of the components of a graphics system and become familiar with building the approach of graphics system components and algorithms related with them. ● To learn the basic principles of 3- dimensional computer graphics. ● Provide an understanding of how to scan convert the basic geometrical primitives. ● Provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections. ● To be able to discuss the application of computer graphics and Multimedia. ● To comprehend and analyze
MCA 303_ET4 Digital Image Processing	● To familiarize students with an overview of the basic concepts of Digital Image Processing ● To understand the processes of improving the quality of an image ● To familiarize the students about the concept of slicing a digital image ● To expose the students towards real-world applications of image processing
MCA304_ET1 Cloud Computing	The course aims to ● To Understand the fundamental concepts of cloud computing. ● To impart basic insights cloud computing architecture and virtualization in the cloud. ● To understand data storage and different cloud computing services ● To Understand cloud security and tools and technologies used for cloud computing ● To provide basic insights into various cloud platforms used in industry, cloud computing applications future directions and trends.
MCA 304_ET2 Cryptography and Network Security	The course aims to provide ● Provide an understanding of data security using various cryptographic algorithms. ● Enable students to identify the underlying network data security. ● Identify the implementation of cryptographic methods to provide email and web security.

MCA 304_ET3 Business Management And Information System	● To understand the concepts of managerial functions and practices and to introduce organization structure. ● To Familiarize participants with the different kinds of Information Systems in Business ● To make the participants familiarize with the Information Technologies and Methods used for effective Decision making in an organization. ● To provide basic insights into the concepts of global business systems. ● To familiarize the software project management environment.
MCA304_EL4 Internet of Things (IoT)	**Course Objectives** ● To understand the concepts of Internet of Things and be able to build IoT applications. ● To understand various building blocks and working of state-of-the-art IoT systems. ● To get insights to conceive and build IoT systems on their own.
MCA CT 305 Python Programming for Data Science	● To provide knowledge of different data types, basic data structures and other programming constructs of Python programming language. ● To provide the student with an adequate understanding of python programming concepts and principles to enable them to design efficient programs. ● To impart knowledge to develop web-based applications using the Django framework. ● To equip the students to prepare, analyze and visualize the data from the large quantity of data given and also to implement the machine learning algorithms
MCA CP 306 Advance Operating System Lab using Linux	● To introduce the student to the Linux Operating system with particular emphasis on command line ● tools and utilities ● To learn and apply the various commands and utilities related to file system management, process ● Management, program development and data processing. ● To apply the above-mentioned utilities and concepts in the writing of shell scripts

MCA CP 307 Mini Project	● To demonstrate a wide range of skills and knowledge learned ● To encourage the integration of knowledge gained in the previous course units. ● To demonstrate the application of students programming and research skills ● To apply the knowledge to complex computing problems ● To make the student able to specialize in specific areas of computer science
MCA CT 308 Employability Skill Training-Phase 2	• Develop ways to extend and improve interpersonal skills, negotiating skills, leadership skills, creativity and conflict management skills. • Enable students to appreciate the role of body language and voice tone in effective communication. • Evaluate students 'thinking skills and how he/she controls the conversation through listening attentively and then having the perseverance to mould it towards his/her own direction. • Equip students to effectively tackle the interview process, leaving a positive impression with the prospective employer. • Familiarize students with interview questions and interview etiquette. • Help students enhance their Technical skills on an interview basis.

Fourth Semester	
Course	**Outcomes**
MCA CS 401 Seminar	• To make students aware of the Current / Future trends related to Information Technology/ Computer Science/ Computer Application • To improve the presentation skills of the students • To develop the ability to seek clarification and defend the ideas of other research works effectively. • To acquire skills to raise queries and to answer the queries in an effective manner.
MCA CP 402 Main Project	• To demonstrate a wide range of skills and knowledge acquired during the course.

	• To encourage the integration of knowledge gained in the previous course units. • To demonstrate & implement students programming and research skills. • To apply the knowledge to solve complex computing problems. • To make the students capable of specialising in specific areas of Computer Science.
MCA CV 403 Viva-voce	• To learn inter-connect between various subject learned as part of MCA programms • Get holistic view of computer science and it's applications • Get broader and deeper view & understanding of various courses studied

COURSE OUTCOMES (COS)

MASTER OF COMPUTER APPLICATIONS REGULAR [3 YEARS]

FIRST SEMESTER	
Course	**Outcomes**
MCA101T Discrete Mathematics and Statistics	• DiscreteMathematicsexplainsthefundamentalconceptsinmathematics.Itcanbeusedbythestudents in computer science as an introduction to the underlying ideas of mathematics for computer science. It explains topics like mathematical logic, predicates, relations, functions, combinatorics, algebraic structures, recurrence relations and graph theory
	• Probability and Statistics is a subject which helps the students to describe events that do not occur with certainty and make good decisions about uncertain situations.
MCA102T	• Students develop knowledge of basic data
Fundamentals of Data Structures	Structures for storage and retrieval of ordered or unordered data. Data structures include: arrays,
	Linked lists, binary trees, heaps, and hash tables.
MCA103T Paradigms of Programming Languages	Different approaches to programming: functional and logic paradigms. Fundamental concepts of programming languages, including abstraction, binding, parameter passing, scope, control abstractions.
MCA104T Digital Systems &Computer Architecture	Ability to understand basic structure of computer, to perform computer arithmetic operations. Ability to design memory organization that uses banks for different word size operations. To conceptualize the basics of organizational and architectural issues of a digital computer

MCA105T Problem Solving and Programming in C	The course is designed to provide complete knowledge of C Language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switchover to any other language in future.
MCA106P C practicals	The course aims to provide exposure to problem solving through programming. It aims to train the students the basic concepts of C-programming language. The practical sessions are designed to give the students hands-on experience with the concepts.
MCA107P Data Structures through C-practicals	The course is designed to develop skills to design and analyze simple linear and nonlinear data structures. It strengthen the ability to the students to identify and apply the suitable data structure for the given real world problem. It enables them to gain knowledge in practical applications of data structures
MCA108T English for Professional Communication	The main goal of the course is to help the studentsimprovespokenEnglishskillstoenablethemtocommunicatemoreeffectivelyinEnglish.The language skills necessary for effective communication include intelligible pronunciation, stress, listening comprehension skills, vocabulary beyond that of the subject matter, control of English grammar, paraphrasing and elaboration skills, coherent organization of information at sentence and discourse levels and interactive skills to enhance comprehension.
SECOND SEMESTER	
Course	**Outcomes**
MCA201T Optimization Techniques & Numerical Methods	Students need to have a solid intuitive understanding of how and why optimization methods work. This enables them to recognize when things have gone wrong, and to diagnose the source of the difficulty and take appropriate action. It also permits students to see how methods can be combined or modified to solve non-standard problems.

MCA202T Operating Systems	To understand and analyse theory and implementation of :processes, resource control(concurrency etc.), physical and virtual memory, scheduling, I/O and file
MCA203T Database Management Systems	At the completion of this course, students should be able to understand the role of a data base management system in an organization, basic database concepts, including the structure and operation of the relational datamodel, Constructs
MCA204T Data Communications & Networks	This course i s to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, Communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and the ip protocols, various types of networks (LAN, MAN, WAN and Wireless networks)and their protocols
MCA205T Web Technologies	To get in-depth knowledge in web related technologies such as HTML, CSS, XML, JAVA Script, JSP,RUBY, Dotnet Frameworks etc.
MCA206P DBMS practical's	To get hands-on experience on advanced database queries using Structured Query Language(SQL)
MCA207P Web Technologies practical's	To get hands-on experience on HTML, CSS, XML, JAVA Script, JSP, etc
THIRD SEMESTER	
Course	**Outcomes**
MCA301T Principles of Management & Accounting	This course will enable the students to get awareness regarding organizational practices and principles and hence will help in getting the organizational & corporate work culture. It also assists in creating awareness regarding different functions performed by various management levels/departments.

MCA302T Analysis & Design of Algorithms	Provides a detailed study of algorithms and Design.
MCA303T Object Oriented Programming through Java	Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc
MCA304T Software Engineering &Project Management	Discuss software development techniques and methodologies
MCA305T Object Oriented Analysis & Design	Students should be able to use an object-oriented method for analysis and design. Be able to analyse information systems in real-world settings and to conduct methods such as interviews and observations.
MCA306P PHP Programming practical's	To familiarize students with the PHP programming concept and enables them to execute all the programs in lab.
MCA307P OOPS through Java practical's	To inculcate knowledge on Java Programming concepts
FOURTH SEMESTER	
Course	**Outcomes**
MCA401T System Software	To understand the different type of system software, its working principles and design aspects

MCA402T Data Mining	Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors.
MCA403T TCP/IP Protocols	This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models(OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks(LAN,MAN,WAN and Wireless networks) and their protocols.
MCA404T Linux OS and Shell programming	The course introduces basic understanding of UNIXOS, UNIX commands and File system and to familiarize students with the Linux environment. To make students learn the fundamentals of shell script and shell programming. Emphases are on making student familiar with UNIX environment and issues related to it.
MCA405E Big Data	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing. Acquire fundamental enabling techniques and scalable Algorithms like Hadoop, Map Reduce and NOSQL in big data analytics
MCA406P Linux OS & Shell programming Practical	Hands-on experience of UNIXOS, UNIX commands and File system and to familiarize students with the Linux environment
MCA407D Mini Project- Application Development	The aim of the Project work is to acquire practical knowledge on the implementation of the programming concepts studied.

FIFTH SEMESTER	
Course	**Outcomes**
MCA501T User Interface Design	Understand what interaction design is, the importance of user-centered design and methods of user information gathering
MCA502T Knowledge Management & Business Intelligence	The objective of the course is to prepare students to understand the current theories, practices, tools and techniques in knowledge management to deal with the challenges with the organization and management of knowledge. This helps to solve most of the common business problems and helps companies increase their benefits. Business Intelligence is the method of using the knowledge of the impel tools and rigging to propel the business prevent the data distortion and accumulate it at the same time. Knowledge Management and Business Intelligence aims in creating creative knowledge developers to compete with the emerging challenges.
MCA503T Enterprise Resource Planning	To understand the basic structure of ERP, and to apply design principles for various business modules in ERP
MCA504T Advanced Java Programming	To know networking concepts with respect to java domain, and to study advanced concepts related to RMI, CORBA, EJB, Stream Concepts, JSP, JDBC and Servlet Concepts.
MCA505E ADHOC And Sensor networks	To know the constraints of the wireless physical layer that affect the design and performance of ad hoc and sensor networks, protocols and applications. To understand MAC, Routing protocols that have been proposed for ad hoc and sensor networks.
MCA506P Advanced Java Programming practical	To get hands-on experience on advanced concepts in java related to networking domain

MCA507P Python Programming-practical	The course is designed to provide basic knowledge of Python. Python Programming and user support personnel who wish to learn the Python programming language.
MCA508S Main Seminar–Current Trends	The objective of Main Seminar is to help develop the students' simple yet powerful strategies and skills. Students may gain a better insight into the subject. Prepares the students to obtain up positions as system analysts, system designers and programmers in any field related to information technology.
SIXTH SEMESTER	
Course	**Outcomes**
MCA601D Project	The objective of the MCA project work is to develop quality software solution. During the development of the project, the student should involve in all the stages of the software development lifecycle like requirements engineering, systems analysis, systems design, software development, testing strategies and documentation with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, so as to participate and manage a large software engineering projects in future.
MCA602VViva-voce	Students will be evaluated through all core subjects of the MCA programme and marks will be awarded on the basis of oral answers given by the students

COURSE OUTCOMES (COS)

MASTER OF COMPUTER APPLICATIONS LATERAL [2 YEARS]

THIRDSEMESTER	
Course	**Outcomes**
MCA301T Principles of Management & Accounting	This course will enable the students to get awareness regarding organizational practices and principles and hence will help in getting the organizational & corporate work culture. It also assists in creating awareness regarding different functions performed by various management levels/departments.
MCA302T Analysis & Design of Algorithms	Provides a detailed study of algorithms and Design.
MCA303T Object Oriented Programming through Java	Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc
MCA304T Software Engineering &Project Management	Discuss software development techniques and methodologies
MCA305T Object Oriented Analysis & Design	Students should be able to use an object-oriented method for analysis and design. Be able to analyse information systems in real-world settings and to conduct methods such as interviews and observations.
MCA306P PHP Programming practical's	To familiarize students with the PHP programming concept and enables them to execute all the programs in lab.

MCA307P OOPS through Java practical's	To inculcate knowledge on Java Programming concepts
FOURTHSEMESTER	
Course	**Outcomes**
MCA401T System Software	To understand the different type of system software, its working principles and design aspects
MCA402T Data Mining	Understand data mining principles and techniques: Introduce DM as a cutting edge business intelligence method and acquaint the students with the DM techniques for building competitive advantage through proactive analysis, predictive modeling, and identifying new trends and behaviors.
MCA403T TCP/IP Protocols	This course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models(OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks(LAN,MAN,WAN and Wireless networks) and their protocols.
MCA404T Linux OS and Shell programming	The course introduces basic understanding of UNIXOS, UNIX commands and File system and to familiarize students with the Linux environment. To make students learn the fundamentals of shell script and shell programming. Emphases are on making student familiar with UNIX environment and issues related to it.

MCA405E Big Data	Understand the key issues in big data management and its associated applications in intelligent business and scientific computing. Acquire fundamental enabling techniques and scalable Algorithms like Hadoop, Map Reduce and NOSQL in big data analytics
MCA406P Linux OS & Shell programming Practical	Hands-on experience of UNIXOS, UNIX commands and File system and to familiarize students with the Linux environment
MCA407D Mini Project- Application Development	The aim of the Project work is to acquire practical knowledge on the implementation of the programming concepts studied.
FIFTH SEMESTER	
Course	**Outcomes**
MCA501T User Interface Design	Understand what interaction design is, the importance of user-centered design and methods of user information gathering
MCA502T Knowledge Management & Business Intelligence	The objective of the course is to prepare students to understand the current theories, practices, tools and techniques in knowledge management to deal with the challenges with the organization and management of knowledge. This helps to solve most of the common business problems and helps companies increase their benefits. Business Intelligence is the method of using the knowledge of the impel tools and rigging to propel the business prevent the data distortion and accumulate it at the same time. Knowledge Management and Business Intelligence aims in creating creative knowledge developers to compete with the emerging challenges.

MCA503T Enterprise Resource Planning	To understand the basic structure of ERP, and to apply design principles for various business modules in ERP
MCA504T Advanced Java Programming	To know networking concepts with respect to java domain, and to study advanced concepts related to RMI, CORBA, EJB, Stream Concepts, JSP, JDBC and Servlet Concepts.
MCA505E ADHOC And Sensor networks	To know the constraints of the wireless physical layer that affect the design and performance of ad hoc and sensor networks, protocols and applications. To understand MAC, Routing protocols that have been proposed for ad hoc and sensor networks.
MCA506P Advanced Java Programming practical	To get hands-on experience on advanced concepts in java related to networking domain
MCA507P Python Programming-practical	The course is designed to provide basic knowledge of Python. Python Programming and user support personnel who wish to learn the Python programming language.
MCA508S Main Seminar–Current Trends	The objective of Main Seminar is to help develop the students' simple yet powerful strategies and skills. Students may gain a better insight into the subject. Prepares the students to obtain up positions as system analysts, system designers and programmers in any field related to information technology.
SIXTH SEMESTER	
Course	**Outcomes**

MCA601D Project	The objective of the MCA project work is to develop quality software solution. During the development of the project, the student should involve in all the stages of the software development lifecycle like requirements engineering, systems analysis, systems design, software development, testing strategies and documentation with an overall emphasis on the development of reliable software systems. The primary emphasis of the project work is to understand and gain the knowledge of the principles of software engineering practices, so as to participate and manage a large software engineering projects in future.
MCA602VViva-voce	Students will be evaluated through all core subjects of the MCA programme and marks will be awarded on the basis of oral answers given by the students

MASTER OF BUSINESS ADMINISTRATION

PROGRAM OUTCOMES

- **PO1:** Acquire Application-oriented Knowledge in Domain and Business Environment (AKDBE)
- **PO2**: Demonstrate Critical Thinking, Business Analysis, Problem Solving, and Innovative Solutions (CBPI)
- **PO3:** Apply Social Responsiveness and Ethical Standards (SRES) in decision making
- **PO4:** Learn about Astute Leadership and Synergy (ALS)
- **PO5:** Demonstrate Effective Communication (EC) skills
- **PO6:** Integrate Global Exposure and Cross-Cultural Sensitivity (GECCS) while managing business issues in multiple contexts

PROGRAM-SPECIFIC OBJECTIVES

MBA FINANCE

- PSO1: Understand the concepts such as finance theories, practices, Investment strategies, Securities and portfolio management, Local and global economics, Direct and indirect taxation, financial services, Business analytics
- PSO2: Elucidate the organizational financial context for making financial decision-making.
- PSO3: Analyze and choose company reports, forecast economic trends, take measures value stock, investment portfolios, risk and return, various financial services available in the economy.
- PSO4: Integrate various techniques, and financial data effectively.
- PSO5: Apply the principles of financial risk management.

MBA MARKETING

- PSO1: Understand the basics concepts of marketing
- PSO2: Apply relevant marketing knowledge and skills to manage the complexities of the market**.**
- PSO3: Analyze and develop appropriate marketing strategies that will help in achieving the organization's goals.
- PSO4: Impart in-depth knowledge of marketing theories and practices
- PSO5: Elucidate in detail the organizational context of marketing decision-making.
- PSO6: Analyze and evaluate various theories, methods, and systems needed for the strategic analysis, development, execution, and measurement of marketing programs.

MBA HR

- PSO1: Develop critical thinking skills, knowledge, and a holistic HR Professionalism on both core business and people-related challenges.
- PSO2: Develop the students as HR specialists with competencies and the right attitude for today's business environment.
- PSO3: Develop competencies such as knowledge of the business, personal credibility, functional HR expertise, and management of Change.
- PSO4: Provide a competitive edge for formulating sustainable HR solutions for business challenges.
- PSO5: Evaluate the HR strategies related to various HR functions

MBA OPERATIONS

- PSO1: Understand the tools that aid in devising the methods of goods production and advanced techniques for managing operations.
- PSO2: Discuss the factors affecting production and operations and teaches qualitative and quantitative forecasting techniques
- PSO3: Provide insight about the practical aspects and latest developments in the field of Inventory control and management.

- PSO4: Analyze the concept and techniques for Quality Management and control and how and why it is important in the present context.
- PSO5: Identify the problems and challenges faced in the field of logistics and Supply Chain Management. It teaches the technical and managerial elements related to the smooth functioning of the field.
- PSO6: Evaluate the basic toolkit necessary for decision making with regard to Operations Department

MBA INFORMATION SYSTEMS

- PSO1: Recognize contemporary MIS theory and how information systems support business strategy, business processes, and practical applications in an organization.
- PSO2: Interrelate how various support systems can be used for business decisions and to sustain competitive advantage.
- PSO3: Describe how the Internet and World Wide Web provide a global platform for e-business, business mobility and communications, collaboration, and cloud computing.
- PSO4: Express the proven value of, and the relationship between business data, data management, and business intelligence.
- PSO5: Analyze systems development and project management methodologies.
- PSO6: Combine analytical thinking, creativity, and business-problem-solving as applied to ongoing MIS challenges, future trends, and relevant case studies.
- PSO7: Express ethical awareness and moral reasoning applied to MIS problem, issue, or case study

Semester	**Course**	**Outcome**

S1	**Management Concepts and Organisational Behaviour**	CO-1: Apply the concept of the decision-making process in the changing business scenario (K3) CO-2: Explain the management's functions and its relevance an Organizational Perspective (K2) CO3: Analyze the different organization structures (K4) CO4: Explain the basics of learning, personality, perception, attitude, and learning (K2) CO5: Analyze the motivation behind the behavior of people in the organization (K4) CO6: Explain group dynamics and demonstrate skills required for working in groups (team building) (K2)
S1	**Business Communication**	CO 1- To remember the concept of business communication [K1] CO 2- To Understand various forms of corporate communication [K2] CO 3- To understand and acquire knowledge regarding oral and written communication [K2] CO 4- To understand the listening skills and analyses factors affecting the listening skills [K2 & K4] CO 5 To evaluate the verbal and non-verbal forms of communications [K5] CO 6 To create various reports and organizational written documents [K6]
S1	**Managerial Economics**	CO 1-To Recognize the concepts of Managerial Economics and to apply this knowledge in business decision-making (K1) CO 2-To Discuss the concepts and techniques of Economics used in Managerial Economics (K2) CO 3- To Demonstrate the core areas in Economics like demand, production, markets, etc (K3)

		CO 4-To Examine the different market conditions and its features (K4) CO 5- To Evaluate various pricing strategies practiced by the business world (K5) CO 6- To originate Economic sense among the students to manage their resources to maximize their wellbeing, happiness, and satisfaction (K6)
S1	**Accounting For Management**	CO1- To remember various concepts related to Financial, Cost, and Management Accounting (K1) CO 2- To understand various roles of accounting in managerial decision making (K2) CO 3- To elucidate the concept of modern branches of accounting (K3) CO 4- To prepare the income statement and balance sheet of trading firms (K4) CO5- To analyze and interpret financial statements using different tools of analysis (K5) CO 6- To apply costing techniques and evaluate corporate restructuring strategies (K6)
S1	**Quantitative Methods**	CO1. To familiarize the students with Mathematical and Statistical techniques applied in Management. CO2. To enable the students to solve statistical problems for summarizing, analysing, and interpreting Data CO3. To impart fundamentals of Hypothesis Testing CO4: Apply theoretical probability distributions in Business CO5: Understand the trend and projection by correlation, Regression and Trend Analysis
S1	**Legal Environment of Business**	CO1- To remember various terms related to business law (K1)

		CO 2-To understand the framework of law applicable to business (K2) CO 3-To identify legal requirements for pursuing a business (K3) CO4- To evaluate the legal aspects related to contract, sale of goods, negotiable instrument, partnership, etc (K4) CO5- To construct legal requirements for Memorandum of Association, Articles of Association and Prospectus, Intellectual Property Rights(K5) CO6- To demonstrate the laws applicable for Consumer Protection, Foreign Exchange Management, IT, Competition, Intellectual Property Rights and GDPR. (K6)
S1	**Environment Management**	CO1- To familiarize the participant's framework of Natural Environment and Importance of Protection of Natural Resources (K1) CO 2-To make the participants aware of pollution, waste management, and the importance of environmental sustainability (K2) CO 3-To understand the participants about the Business Environment framework (K3) CO 4-To sensitize the participants on how the Macroeconomic environment affects Organizations (K4) CO5- To analyze the political-legal environment of business (K4) CO6- To evaluate how privatization and globalization influenced Industrial development (K5& K6)
S2	**Financial Management**	CO 1-To explain the concept, objectives, and functions of Financial Management

		CO 2- To understand investment decision and capital budgeting techniques CO 3- To relate the function of financial management to each other CO 4 -To identify the various forms of capital structures and how to ascertain the Cost of Capital. CO5- To apply financial management practices to maximize the value of the firm
S2	**Marketing Management**	CO1- To remember various elements of marketing (K1) CO 2- To have a sound understanding of various elements of marketing (K2) CO 3- To apply key marketing concepts, frameworks, and tools to solve real-time Marketing problems (K3) CO 4- To analyze complex situations of marketing (K4) CO5- To critically evaluate various marketing strategies and practices. (K5) CO 6- To identify and create new ideas, formulate methods, and innovative ways of marketing in the highly competitive world. (K6)
S2	**Human Resource Management**	CO 1- To remember the basic concepts of Human Resource Management [K1] CO 2- To understand the concepts and theories associated with the functions of human resources management [K2] CO 3- To understand and analyse various ways of sourcing human resources [K2 & K4] CO 4- To understand and analyse the methods of developing and managing employee performance [K2 & K4] CO 5- To evaluate and create a compensation plan for the organisation [K5 & K6]

		CO 6- To understand the employee relations & recent trends in human resources management [K2]
S2	**Operations Management**	CO1- To remember various concepts related to Operations Management(K1) CO 2- To understand various concepts and theories related to Operations Management (K2) CO 3- To understand operations strategies adopted by global firms (K2) CO 4- To analyze concepts and practices followed in manufacturing firms (K4) CO5- To analyze operations strategy of Service/ manufacturing sector. (K4) CO 6- To evaluate and design various facility layouts adopted by manufacturing & service sectors (K5 & K6)
S2	**Management Science**	CO1- To identify the possibilities of management science in Business studies (K1) CO 2- To interpret the management issues and develop the solution by effective decisions strategy (K2) CO 3- To understand the basic models and formulations of operations research (K2) CO 4- To understand the applied knowledge of Management science concepts (K2) CO5- To apply the relevant concepts of management science in business areas to solve (K3)
S2	**Management Information System & Cyber Security**	CO1 – To understand the basics foundation of Information Systems in Business (K1) CO2 – To understand the Information Technologies and Methods used for effective Decision making in an organization. (K2)

		CO3 – To understand and apply the strategic role of the information system to continuous improvement. (K2 & K3) CO4 – To analyse and resolve the security and ethical issues in Information systems. (K4 & K5) CO5 – To evaluate the drivers of IT investments and measure and justify the value of IT investments (K6)
S2	**Business Research Methods**	CO-1: Explain basic concepts of Business Research (K2) CO-2: Explain various research designs (K6) CO-3: Develop Appropriate measurement and sampling techniques for conducting research(K6) CO-4: Analyze the methods and techniques involved in data collection (K4) CO-5: Apply statistical tools for data analysis (K3) CO-6: Create effective business reports (K6)
S2	**Entrepreneurship Development**	CO1. To Recognize the factors affecting the Entrepreneurial Growth K1 CO2. To discuss the Significance of Entrepreneurship in economic development K2 CO3.To demonstrate the Steps in Entrepreneurial Process including Intellectual Property Creation & ProtectionK3 CO4. To examine the role of supporting institutions for Small and Medium Enterprises K4 CO5.To evaluate the Management of Small and Medium Enterprises K5 CO6. To originate a Spirit of Entrepreneurship among the Student Participants K6
S3		• Use R to create basic plots

	Big Data and Business Analytics	• Identify and apply appropriate Analytic Technique to solve Business Problem • Derive Actionable insights from data for Decision Making
S3	**Business Ethics and Corporate Governance**	• The Participants will understand the importance of Ethics in Business Administration • At the end of the Course, the Participants will understand the relevance of Indian Practices in Management based on Ethical foundation • The Case Studies on Indian Ethos and Values will throw light into the richness of Indian tradition in Corporate Governance
S3	**Security Analysis And Portfolio Management**	CO 1-To Know the theory as well as the practice of investment decision making (K1) CO 2- To understand the theory and practice of portfolio management (K2) CO 3- To relate the risk-return trade-off in different types of securities (K3) CO 4- To plan the portfolio management and the techniques for measuring the performance of portfolios (K4 & 5) CO5- To develop a portfolio and its revision (K6)
S3	**Management Of Banks and Financial Institutions**	• Develop conceptual knowledge on Banking practices and functioning of Financial Institutions • Ability to manage various processes in Banks and Financial Institutions.
S3	**Integrated Marketing Communications**	• The students will be Equipped with the Practical Elements of Marketing Communication

		• The Participants will be enabled to understand the Promotion Process through Integrated Marketing Communications • At the end of this course, the students may be enabled to handle Integrated Marketing Communications Elements
S3	**Services Marketing**	• The Participants will understand the Role and Importance of the Services Sector and the intricacies in Marketing of Services • The Participants will get basic insights into the framework of Services Marketing and how to apply the concepts in Practice • At the end of this course participants are expected to acquire insights into Marketing of Services in different Industries
S3	**Training & Development**	• The Participants will understand the Role and Importance of Training and Development as an HR function • The students will understand how to Analyse Training requirements in an Organisation • At the end of this Course, the Participants will get an overview of different types of Training and Development programs
S3	**Performance & Talent Management**	• The Participants will understand the Conceptual frame of HR Core Function Performance and Talent Management • At the end of this Course, the Participants will get an understanding of the Performance Management Process in Organisations

S3	**Supply Chain Management**	• Acquiring data analysis skills by analyzing and using supply chain data • Ability to undertake supply chain designing
S3	**Total Quality Management**	• Ability to do Quality management practices • Ability to do quality planning activities
S3	**E-Business**	• Through this Course the students will be able to understand the E-Business Technology • The students will also acquire advanced knowledge of technical and business issues related to E-Business and E-Commerce
S3	**Cloud Computing**	• Through this course the students will be able to understand the usage of cloud computing in business management • The students will also be able to understand the various cloud computing models and services
S4	**Strategic Management**	• The Participants will be able to understand the concepts and perspectives in the area of Strategic Management • Participants will acquire the necessary skills in using traditional and contemporary Analytical tools of Strategic Management

		• At the end of the course, participants will develop the ability to take the right Managerial Decisions and solve Business Problems
S4	**International Finance & Forex Management**	• The participants will be able to understand economic concepts used for managerial decision making • The participants will get basic insights into demand and supply side of markets • At the end of this course, the participants will get conceptual clarity and logical aspects of the economic behavior of individuals, firms, and markets. • The participants will be able to understand economic concepts used for managerial decision making
S4	**Management Of Financial Services**	• Understand the role and function of the financial system in reference to the macroeconomy. • Demonstrate an awareness of the current structure and regulation of the Indian financial services sector. • Evaluate and create strategies to promote financial products and services.
S4	**Marketing Research**	• The participants will be able to understand the framework of Marketing Research • The participants will get basic insights into Applications of Marketing Research • At the end of this course, the participants will get basic knowledge on various tools of Marketing Research
S4	**Counseling Skills For Managers**	• The Participants will get an overview of Counseling and its nuances • The Participants may gain insights into the Processes and Procedures involved in Counseling

S4	**Leadership For Managerial Performance**	• The Participants will understand about Leadership Approaches and Styles and the Role of Effective Leadership in Organisations • The Participants will be able to comprehend the Issues related to Leadership and the Status of Women Leadership
S4	**Materials And Purchase Management**	• Acquiring Purchasing and Material Planning skills • Ability to conduct stores auditing
S4	**Global Operations And Logistics Management**	• Ability to analyze the risks associated with operations and logistics • Ability to measure and evaluate the performance of global logistics
S4	**Information Security Management**	• Through this course the students will be able to understand the importance of information security management in an organisation. • The students will also be able to understand the various information security threats and ways to manage them.
S4	**E-Business Strategy**	• Through this course the students will be able to understand various e-business models and strategies • The course will also equip the students to formulate and implement the E-Business strategies in an organisation

SCHOOL OF BIOSCIENCES

MASTER OF SCIENCE

MSc Degree Programme is a 2 year Post Graduate Programme. The programme is under the Credit Semester Scheme, consisting of four semesters spread over a period of two years. The programme and syllabus is in compliance with the UGC minimum standards for the conduct and award of post graduate degree.

PROGRAMME OUTCOMES (POs)

At the end of the MSc Programme, graduating students/graduates will be able to:

PO1: Knowledge

Apply the basic scientific principles and analytical techniques to find solutions for a tenable future.

PO2: Technical Competence

Create, select, and apply modern techniques or resources necessary for the practice of knowledge gained.

PO3: Critical Inquiry

Use research methods and critical inquiry in a scientific problem including the design of experiments, analysis and interpretation of data to provide valid conclusions or solutions.

PO4: Environment and sustainability

Understand the impact of professional competence in societal and environmental contexts, and exemplify the need for sustainable development.

PO5: Ethics

Apply ethical principles in decision making and commit to professional ethics in the practice of science.

PO 6: Communication

Competence in oral, written and visual communication within the professional community and with the society at large.

PO 7 - Lifelong learning

Recognize the need for, and have the preparation and ability to engage in independent, interdisciplinary and life-long learning.

PROGRAMME SPECIFIC OUTCOMES

BIOCHEMISTRY

PSO1: Understand the structure-function relationships of macromolecules and the interaction between macromolecules and cellular processes at the molecular level.

PSO2: Acquire scientific knowledge in tools and techniques used in biochemical analysis and apply in experimental processes.

PSO3: Identify the biochemical basis of metabolical pathways, regulation and gene expression to generate probable solutions for the treatment of medical disorders.

PSO4: Gain proficiency in laboratory techniques in both biochemistry and molecular biology and be able to apply the scientific method to the processes of experimentation.

PSO5: Realize the impact and applications of biochemistry in society.

PSO6: Present the results, conclusions, and relevance of scientific experiments to a specific audience.

BIOINFORMATICS

PSO1: Effectively utilize biological databases for the creation, compilation and analysis of scientific data.

PSO2: Analyze biological data for generating new knowledge that benefits the environment and society.

PSO3: Formulate computational algorithms for the application of dynamic biological processes in science.

PSO4: Interpret the biological processes at molecular level using computational aids.

PSO5: Incorporate ethical practices in the application of bioinformatics.

FOOD TECHNOLOGY AND QUALITY ASSURANCE

PSO1: Correlate cutting-edge technology and science in order to improve food production, packaging, consumption, safety, and hygiene.

PSO2: Implement diverse food commodity manufacturing, processing, and packaging processes.

PSO3: Analyze and ensure the quality and safety of food using chemical and microbial analytical techniques.

PSO4: Produce qualified professionals well versed in food regulations who can improve the agricultural and food processing industries' standards.

PSO5: Contribute to the growth and development of the agriculture and food processing industries, resulting in the development of new products.

PHYTOMEDICAL SCIENCE AND TECHNOLOGY

PSO1: Demonstrate the ability to work critically with theoretical and research-based knowledge of medicinal plants and their context within the scientific communities

PSO2: Critically review the scientific knowledge of traditional and modern systems of medicine and the quality systems in the phytopharmaceutical industry

PSO3: Process and interpret analytical data, formulate conclusions and evaluate with respect to uses of local and indigenous plants.

PSO4: Explain pharmacognosy in phytotherapy, and its importance in safety and efficacy of herbal medicine

PSO5: Apply basics of biological sciences to the cultivation, storage and effective management of raw drugs or herbal medicines and their molecular mechanism of action.

PSO6: Acquire knowledge about the economical importance of medicinal aromatic plants and learn the managerial operations of a phytomedical industry

PLANT BIOTECHNOLOGY

PSO1: Express the basic concepts of biological sciences and apply this knowledge to the comprehension of biotechnological applications

PSO2: Examine the molecular and genetic aspects of plant systems to the development of biotechnological interventions in plant science

PSO3: Critical evaluation of plant tissue culture techniques for the conservation of endangered and conserved plant species.

PSO4: Develop awareness regarding the process of genetic engineering, and evaluate its application in the fields of genomics and proteomics of plant systems

PSO5: Explore the important adaptive mechanisms of plants against stress factors that leads to the generation of Bioenergy

PSO6: Equip students with the knowledge of applied research and issues involved in their pursuit of academic goals in terms of intellectual property rights, patents and related acts and laws.

BIOTECHNOLOGY

PSO1: Acquire knowledge on the fundamentals of cells, genes, and bio-molecules along with an understanding of instrumentation and software tools which enables them to understand the basic concepts in life sciences.

PSO2: Acquire knowledge on the interconnection between the basic concepts with the disciplinary and interdisciplinary aspects of biotechnology.

PSO3: Impart practical skills and scientific knowledge in various domains of Biotechnology

PSO4: Develop ability to tackle problems by utilizing the conceptual knowledge, analytical techniques, computational and statistical approaches

PSO5: Understand the current developments in the different areas of biotechnology and enable them to pursue careers in academic and industry in the areas of pharmaceutical and biotechnology

BIONANOTECHNOLOGY

PSO1: Understand the basics of biological macromolecules and their interactions at the molecular and cellular levels

PSO2: Develop an expertise in characterisation and synthesis of nanoparticles and bionanoconjugates.

PSO3: To understand the interaction of nanoparticles with biological systems and their applications in different fields.

PSO4: Construct and control nanoscale events using guidance from natural systems and develop awareness of industrial trends in nanotechnology

PSO5: Evaluate the social, ethical and environmental impacts of nanoparticles and nanomaterial

COURSE OUTCOMES (COS)

MASTER OF SCIENCE (MSc) [2 YEARS]

MSc BIOTECHNOLOGY	
FIRST SEMESTER	
Course	**Outcome**
BT020101 **General biochemistry**	CO1:Illustrate different classification of carbohydrates and their functions (K1) CO2:Classify lipids and illustrate their properties(K3) CO3:Describe different types of protein with their structure and function(K1) CO4:Distinguish the different types of Vitamins (K2) CO5:Explain the structure and function of nucleic acid(K2) CO6:Summarize different class of hormones(K2)
BT020102 **Cell biology and genetics**	CO1:Summarize the history of cell biology and could relate and distinguish between the structural organization of a prokaryotic and eukaryotic cell(K2) CO2:List different organelles in cells and describe their molecular and functional organization(K1) CO3:Distingush between various transport mechanisms across the cell membrane(K2) CO4.Describe mechanisms involved in cell cycle and cell signalling pathways(K1) CO5.Explain the the organization of Genes and chromosomes and could summarize the events of cell cycle and its regulation (K2)

	CO6: Relate the fundamental principles of heredity and it deviation from Mendelian behavior (K2) CO7: Explain the effect of mutations, mutational analysis, Principles of behavioral genetics and population genetics(K2)
BT020103 **Instrumentation and Biostatistics**	CO1:Describe the theoretical and technical aspects of various microscopy methods(K1) CO2:Explain the methodology and instrumentation of various spectroscopic methods(K2) CO3:Explain the application and methodology of various Chromatographic techniques(K1 &K2) CO4:Examine the methods Electrophoresis and Centrifugation(K1&K2) CO5:Define radioactivity and explain various detection methods and their application(K3) CO6:Explain various biostatistics methods used in in biological sciences and their usage in right occasions(K3&K4)
BT020104 **Biophysics and Bioinformatics**	CO1:Explain the concept of bioenergetics of cell (K2) CO2:Describe basic architecture and properties of DNA(K1) CO3:Demonstrate different interaction between macromolecules(K3) CO4:Summarize the role of bioinformatics in biological data storage(K2) CO5:Apply bioinformatics tools for analyzing biological data(K3)

BT020105 **Lab course I**	CO1:Extend the basic principles of standard solution preparation(K2) CO2:Demonstrate the various analytical techniques like spectroscopy, chromatography and electrophoresis(K3) CO3:Estimate the amount of polysaccharide, protein and lipids in isolated sample(K5) CO4:Evaluate Saponification value, iodine value of a given fat sample(K5) CO5:Analyse problems in genetics(K4) CO6: Analyse problems in bio-statistics(K4.)
SECOND SEMESTER	
BT020201 **Microbiology**	CO1: Recall the microbial world and their interactions with the environment(K1) CO2: Apply the knowledge to understand the microbial physiology and to identify the microorganisms. (K2) CO3: Formulate the importance of sterilization and disinfection and the methods used in a microbiology laboratory(K3) CO4: Classify different types of microbes like fungi and virus and explain the mechanism of interaction(K3 &K2) CO5:Evaluate the regulation of biochemical pathways in microbes(K5)
BT020202 **Immunology**	CO1: Describe cellular and molecular basis of the immune system.(K2 CO2:Explain how the innate and adaptive immune responses coordinate to fight against invading pathogens(K2) CO3:Differentiate between the types of antigen-antibody interaction and the different immunological assays based on the interaction(K4)

	CO4:Appraise the structure and functions of immune molecules (MHC,IgG,complement system, cytokines)(K4) CO5: Identify the genetic defects that lead to immunodeficiency diseases, autoimmune diseases and hypersensitivity reaction and their treatment as well as the current status of gene therapy(K1) CO6: Describe about the vaccines in use and the strategies to develop vaccines of the future.(K2 &K6)
BT020203 **Molecular biology**	CO1: Understand the molecular mechanisms underlying central dogma of genetics (K2) CO2: Know about the molecular mechanism for gene regulation(K2) CO3: Describe the importance of Nucleic acid as a therapeutic agent(K3& K6) CO4: Realise the different molecular tools and strategies in practice in genetic engineering.(K2&K3) CO5:Appreciate the applications of rDNAtechnology in various fields.(K2& K6)
BT020204 **Metabolism and Enzymology**	CO1:Describe structure, functions and mechanism of action of enzymes(K2) CO2:Classify enzymes based on the reactions catalyzed and understand kinetics(K2) CO3: Correlate Inhibition and regulation of enzyme catalyzed reactions. (K3) CO4:Define the major pathways of intermediary metabolism and discuss their energetics localization and cellular compartmentalization(K1) CO5:Correlate the metabolic activity of tissues and organs with their function and discuss how derangements in metabolism leads to diseases.(K3)

BT020205 **Lab course II**	CO1:Able to cultivate and characterize microorganisms in an aseptic condition (K1) CO2:Course acquaints students with basic concept of immunity and its application(K2) CO3:Well expertise in molecular level characterization of biomolecules (K2) CO4:The students will have knowledge of tools and strategies used in genetic engineering(K2)
THIRD SEMESTER	
BT020301 **Bioprocess Technology**	● The students are trained in screening for microbial strains from different samples. ● Types of Bioprocess and standard lab practices. ● Bioreactor designing and control. ● Industrial production conditions through fermentation
BT020302 **Recmbinant DNA Technology**	● The student is exposed to the basic requirements to perform genetic engineering experiments. ● The techniques involved in the preparation and introduction of rDNA to the host. ● Applications of rDNA technology. ● Regulations in carrying out rDNA experiments.
BT020303 **Environmental biotechnology**	● The student is able to understand the role of biotechnology in environmental applications. ● Degradation of recalcitrant compounds by biological agents. ● Treatment technologies involved in the processing of solid and liquid waste. ● Alternate green energy sources and green technologies.

BT020304 **Animal And Plant Biotechnology**	● Students get familiarized with the fundamental requirements and design of lab to carry out plant and animal cell culture experiments. ● The different approaches and techniques involved in creating recombinant plant and animals. ● The applications and demerits of genetic modification in plants and animals
BT020305 **Laboratory Course III**	● Students are trained in characterising waste water, bacteriological analysis of water and food, plant tissue culture techniques and other lab scale bioprocesses.
FOURTH SEMESTER	
Elective Group 1	
BT830401 **Environment and Biotechnology**	● Students can understand the structure of the environment, the global environmental issues, the necessity to conserve environment and strategies for conservation ● The biotechnological approaches in environmental studies.
BT830402 **Food biotechnology**	● Students can understand applications of biotechnology in food production. ● Enhancing the quality and quantity of food materials through genetic engineering ● The rules and regulations in genetic modification of food.
BT830403 **Advanced Molecular Techniques**	● The students become familiar with the principles and the applications of current advanced molecular techniques and methods. ● Recognize the difference between various molecular techniques as well as their strength and limitations

BT020401 **Lab Course**	● Students are trained in isolation of genetic material, purification. ● Modification of genetic material, generation and introduction of r DNA, analysis of genome.
BT020402 **Project and Dissertation**	● Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project.
BT020403 **Comprehensive viva voce**	● A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. ● Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students

MSc BIOCHEMISTRY	
FIRST SEMESTER	
Course	**Outcome**
BC010101 **Biomolecules and Structural Biology**	CO1:Describe the classification of biomolecules(K1) CO2:Analyse and study the chemical and biochemical properties of bio molecules(K2) CO3:Know about the interactions between macromolecules(K2) C04:Describe the reactivity of functional groups and the importance of stereoisomers in biological systems(K2) CO5:Analyse the structure- function relationship of biomolecules(K2) CO6:Relate the contributions of scientist in order to create scientific interest amongst students in life processes(K2)
BC010102 **Analytical Biochemistry and Bioinformatics**	CO1:Describe the theoretical and technical aspects of various blotting techniques used in biochemistry(K1) CO2:Explain the principle and methodology of various spectroscopic methods(K2) CO3:Explain the application and methodology of various Chromatographic techniques(K1&K2) CO4:Examine the methods Electrophoresis and Centrifugation(K1 &K2) CO5:Define radioactivity and explain various detection methods and their application(K3) CO6:Articulate nature and scope of Bioinformatics, Biological Databases and Bioinformatics tools to explore biological data(K3 &K4)

BC010103 **Cell Biology and Genetics**	CO1: Relate and distinguish between the structural and functional organization of a prokaryotic and eukaryotic cell(K2) CO2:List different organelles in cells and describe their molecular and functional organization(K1) CO3:Describe mechanisms involved in cell cycle (K1) CO4:Outline the structural and functional aspects of cell membrane (K2) CO5:Explain various means of transport of molecules with in the cell and across cell membrane(K2) CO6:Explain the events in cell death, cancer progression, its regulation and cell signalling(K2) CO7:Relate the fundamental principles of heredity and its deviation from Mendelian behaviour(K2)
BC010104 **Human Physiology and Biostatistics**	CO1: Describe the tissues and organs of the human body(K2) CO2: Demonstrate the ability to differentiate physiology from the cellular and molecular level to the organ system.(k2 & k4) CO3:Discuss about Muscle and cardiovascular physiology(K2) CO4:Discuss about Renal and respiratory physiology(k2) CO5:Appraise the role of statistics in research (K4)

BC010105 **Laboratory course I**	CO1:Learn how to prepare various Solutions(K1) CO2:Estimation of major macromolecules present in the biological sample qualitative and quantitative methods(K2) CO3:Practice the evaluation of different blood parameters(K3) CO4:Track various techniques adopted for separation of biomolecules(K2) CO5:Apply various applications of bioinformatics and biostatistics (K3)
SECOND SEMESTER	
BC010201 **Metabolism and Bioenergetics**	CO1:Discuss the overall concept of cellular metabolism –anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis(K2) CO2:Explain the basic concept of thermodynamics(K2) CO3: Explain the various metabolic pathways and its significance in the human body(K2) CO4: Describe the various metabolic enzymes associated in the metabolic pathways(K2) CO5:Explain the basic concept of metabolomics(K2) CO6:Explain the hormonal level regulation of cellular metabolism (K2)
BC010202 **Molecular Biology & Genetic Engineering**	CO1: Understand the molecular mechanisms underlying central dogma of genetics (K2) CO2: Know about the molecular mechanism for gene regulation(K2)

	CO3: Describe the importance of Nucleic acid as a therapeutic agent(K3& K6) CO4: Apply molecular tools strategies in genetic engineering.(K3) CO5: Appreciate the applications of rDNA technology in various fields.(K2& K6)
BC010203 **Immunology**	CO1: Describe cellular and molecular basis of the immune system.(K2 CO2:Explain how the innate and adaptive immune responses coordinate to fight against invading pathogens(K2) CO3:Differentiate between the types of antigen-antibody interaction and the different immunological assays based on the interaction(K4) CO4:Appraise the structure and functions of immune molecules (MHC, IgG, complement system, cytokines)(K4) CO5: Identify the genetic defects that lead to immunodeficiency diseases, autoimmune deseases and hypersensitivity reaction and their treatment as well as the current status of gene therapy(K1) CO6: Describe about the vaccines in use and the strategies to develop vaccines of the future.(k2 &k6)
BC010204 **General Microbiology**	CO1:Learn the diversity of the microbial world and their interactions with the environment(K1) CO2: Summarize the nutritional status and factors influencing the growth of bacteria nutrition(K2)

	CO3: Apply the knowledge to understand the microbial physiology and to identify the microorganisms. (K2) CO4: Formulate the importance of sterilization and disinfection and the methods used in a microbiology laboratory(K3) CO5:Know about the genetic materials and different genetic mechanisms in bacteria and their role in the transmission of characters(K2) CO6: Classify and analyse types and properties of fungus and virus (K3 &K4)
BC010205 **Laboratory course II**	CO1:Able to cultivate and characterize microorganisms in an aseptic condition(K1) CO2:Course acquaints students with basic concept of immunity and its application(K2) CO3:Well expertise in molecular level characterization of biomolecules (K2) CO4:The students will have knowledge of tools and strategies used in genetic engineering(K2)
THIRD SEMESTER	
BC010301 **Enzymology**	● Describe structure, functions and mechanism of action of enzymes ● Classify enzymes based on the reactions catalysed and understand kinetics ● Inhibition and regulation of enzyme catalysed reactions.
BC010302 **Plant Biochemistry**	● To evaluate the phytoconstituents and their application in drug development ● Know about phytohormones and its applications in agriculture ● Understand the applications of plant lectins in the purification of glycans and know how plants survive stress conditions and climate change.

BC010303 **Molecular Endocrinology**	● To understand the different cellular signals and regulation of metabolic activities ● Understand the mechanism of action of hormones, different types of receptors and analyze cellular mechanism of hormonal control in diseased condition.
Elective -1	
BC810301 **Biochemical Toxicology**	● To understand the basic concepts in toxicology and the mechanisms of drug interaction ● Understand the methods of toxicity studies, symptoms and treatment during poisoning.
BC010304 **Laboratory course III**	● To develop skills of performing basic biochemical tests important in clinical investigations ● To develop familiarity with biochemical laboratory techniques, and to introduce students to various practical aspects of enzymology and their correlation in disease conditions
FOURTH SEMESTER	
BC010401 **Clinical Biochemistry**	● To understand the inborn errors of metabolism, in-depth, analysis, evaluation and interpretation the common result patterns in routine clinical biochemistry ● Understand the importance of quality control in clinical laboratories and evaluate the various molecular markers in the diagnosis of diseases.

BC810402 **Research Methodology, IPR and Bioethics**	● Be familiar with the different types and methods of research and how to present scientific data. ● Be aware of legal rights of intellectual activity in the industrial, scientific, literary and artistic fields. ● To realise the problems and ethical issues related to Bioscience research.
Elective -3	
BC810403 **Nanobiology**	● Analyse cutting edge concepts and technologies of nanotechnology in the field of Biology. ● Discuss different tools and techniques that are being used in the field, and where these technologies are heading to. ● Understand about the applications of nanobiology in the emerging areas such as Nano-medicine, Bio-mimicry to create Nano-materials, and Nano-biotechnology. ● Gain an insight into the ethical issues that are associated with the study of nanoscience, its role in law and policy making.
BC010402 **Laboratory course IV**	● The student will be able to clinically assess the laboratory indicators of physiologic conditions and diseases.
BC010403 **Project**	● Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project.
BC010404 **Viva Voce**	● A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. ● Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students

MSc PLANT BIOTECHNOLOGY	
FIRST SEMESTER	
Course	**Outcome**
BS010101 **Biochemistry and Cell Biology**	CO1: Relate fundamental concepts of cell biology and biochemistry(K2) CO2: Enlist and describe the cell organelles with their molecular and functional organization(K1) CO3: Explain the classification, structure and functions of biomolecules((K1 &K2 CO4: Analyze and study the biochemical properties of biomolecules(K4) CO5: Classify and explain the role of vitamins,enzymes and hormones (K1&K2)
BS010102 **Microbiology and Immunology**	CO1:Describe the History and Scope of Microbiology(K1) CO2: Classify Microorganisms (K2) CO3: Discuss various sterilization methods. (K1 & K2) CO4:Explain in detail about bacteria and their ecological significance (K1 & K2) CO5:Classify virus and fungi and explain the antiviral and antifungal agents (K3) CO6.Define and demonstrate microbial culture media and methods(K3 & K4) CO7. Define and explain immunity(K1 & K2) CO8. Describe the structure and function of lymphoid organs and cell involved in immune system (K3) CO9. Examine the importance of antigen antibody interactions and its role in diagnosis of diseases(K3 & K4)

BS010103 **Genetics and Molecular Biology**	CO1:Comprehension of basic concepts of the chemical basis of heredity (K1) CO2:Analyse types of methodology in genetics and quantify heritable traits (K4) CO3:Formulate an insight into cellular and molecular mechanisms involved in molecular biology (K3) CO4:Relate the concepts of genetics to the application in bioinformatics (K4) CO5:Analyse the current molecular genetics and genomics(K4)
BS010104 **Bioanalytical Techniques and Bioinformatics**	C01: Describe theoretical and technical aspects of various microscopy methods (K1) CO2: Define and describe the principle and methodology of various spectroscopic methods(K2) CO3: Explain the application and methodology of various Chromatographic techniques(K1& K2) CO4:Examine the methods of Electrophoresis and Centrifugation(K1 &K2) CO5: Explain various PCR techniques and microarray(K3) CO6: Articulate nature and scope of Bioinformatics, Biological Databases and Bioinformatics tools to explore biological data(K3 &K4)
BS010105 **Laboratory course I**	CO1: To develop basic practical experience in analysis,estimation of different macromolecules,genomics and cytology(K6) CO2:Illustrate preparation of different concentration solutions (K2)

	CO3:Create skills for Culture, isolation and identification of microbes in immunology and enzymology(K6) CO4:To develop skills to handling basic bioinformatics tools(k6) CO5: Demonstrate the various analytical techniques like chromatography, Spectroscopy& Electrophoresis(K3)
SECOND SEMESTER	
BS010201 **Plant Cell Tissue and Organ Culture**	CO1: Explain the history and basics of plant tissue culture (K1& K2) CO2:Develops idea about methods in plant tissue culture(K2& K3) CO3:Understand the biochemical and molecular basis of tissue culture (K2) CO4:Make the students aware about the basic principle and idea about Cloning and storage methods in plant tissue culture (K2 &K3) CO5:Providing basic knowledge about plant breeding (K2) CO6:Understand the application of plant tissue culture in crop improvement (K1 &K2)
BS010202 **Genetic Engineering**	CO1:Describe various genetic tools used in Genetic Engineering such as different modifying enzymes(K1) C02:Explain various vectors used in Genetic Engineering and describe different cloning methods(K2) CO3:Define host system and explain various bacterial and eukaryotic host systems(K1 & K2)

	CO4:Describe various gene delivery methods and the construction of gene library(K1&K2) CO5:Define the term gene editing and explain different modern gene editing methods(K3) CO6:Describe the theoretical and technical aspects of various blotting techniques.(K3&K4) CO7:Explain the principle and methodology of various next generation sequencing methods.(K3& K4)
BS010203 **Metabolism and Metabolic Engineering**	CO1: Conceptualize the term thermodynamics and bioenergetics(K1) CO2: Familiarize with various metabolic pathways and its significance in the human body. CO3: Summarize various primary metabolic pathways in a plant cell.(K2) CO4: Articulate the production of biologically important plant secondary metabolites.(K3) CO5: Explain the basic concept of metabolomics(K2) CO6: Conceptualize various types of Metabolic engineering process in for plant crop improvement(K3)
BS010204 **Biomass and Bioenergy**	CO1 : Identifies the global status of renewable energy resources and their utilisation trend (K1 & K2) CO2: Classify and compare different bioenergy sources (K2) CO3: Appreciate diverse biomass sources including waste generated, and the technology to tap them and convert to biofuels and bioenergy (K5)

	CO4: Value the importance of biodiversity studies followed by bio prospecting involving algae,fungi and plants for identifying candidate organisms for biofuel production (K5) CO5: Design a workflow to utilise the potential biomass sources around the student's locality (K5 & K6)
BS010205 **Laboratory course II**	CO1:Practical knowledge regarding formulation of tissue culture media(K2& K3) CO2: Preparation of explants and inoculation, sub- culture of callus; Regeneration of plants from callus (K3& K4) CO3: Hardening techniques of tissue culture plantlets. (K3 &K4) CO4: Preparation of artificial seeds. Culture of single cells. Technique of cryopreservation. (K2& K3) CO5: practical knowledge regarding methods in plant tissue culture and biomass conversion. (K2)

THIRD SEMESTER	
BS010301 **Plant Stress Biology**	● The course is designed to introduce the student to the field of stress biology in plants. ● The course aims to cover the basics of pathogenesis from the view point of both the host and invading organisms and then the biotic and abiotic stress physiology including the effect of environment on disease development.
BS010302 **IPR and Translational Research**	● Research and need for improvisations necessitates the need for development of new technologies, products and processes. ● The course is designed to make the student aware of legal and other issues

	involved in their pursuit of academic goals in terms of intellectual property rights, patents and related acts, laws and bioethics. ● Also the course has a unit on translational research which aims to impart in the student the idea that the research ultimately has to reach the masses through innovations in fields of medicine and agriculture.
BS010303 **Genomics and Proteomics**	● Deciphering the genetic makeup and protein population in an organism are among the elementary approaches in biological sciences. ● The course is envisaged to provide the student an understanding in genomics and proteomics. ● Different approaches and techniques employed in these fundamental fields of study.
BS010304 **Bioprocess Technology and Engineering**	● Fermentation process is being widely tailor made and used in industries for production of an array of economically important compounds. ● An understanding of the process as performed in laboratories and industries, techniques, design and instrumentation involved, is required for the student and the course aims to cater to this requirement.
BS010305 **Laboratory course III**	● The laboratory course aims to provide the student practical experience in the basic techniques in genetic engineering experiments, plant transformation and formulation and practices in countering pathogen/ pest attack
FOURTH SEMESTER	
Electives **Group A**	
BS800401 **Research Methodology and Science communication**	● The course aims to introduce the student to the philosophy in research and accepted methodologies followed in due course and importance and methods of communicating science effectively.

	● Also a basic understanding regarding biostatistics is also included.
BS800402 **Molecular Techniques for Crop Improvement**	● The course aims to impart in the students an understanding of various molecular approaches followed in crop improvement programmes. ● The students will be introduced largely to the various marker technologies and their applications like in mapping and selection apart from genetic engineering involving nuclear and other organellargenomes,and different traits that are being introduced in the process which helps in crop improvement
BS800403 **Introduction to Nanotechnology**	● The course aims to introduce the field of nanotechnology
BS010401 **Laboratory course IV**	● To impart practical knowledge in plant tissue culture with emphasis on organ culture and protoplast fusion and in the area of molecular markers.
BS010402 **Research Project & dissertation**	● Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project.
BS010403 **Comprehensive Viva-Voce**	● A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. ● Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students

MSc PHYTOMEDICAL SCIENCE AND TECHNOLOGY	
Course	**Outcome**
FIRST SEMESTER	
BS020101 **Microbiology and Plant Molecular Biology**	CO1: Learn the diversity of the microbial world and their interactions with the environment(K1) CO2: Apply the knowledge to understand the microbial physiology and to identify the microorganisms. (K2) CO3: Formulate the importance of sterilization and disinfection and the methods used in a microbiology laboratory(K3) CO4: Know about types and mechanism of host-parasite interactions (K2) CO5: Familiar with production of variations economically relavant biomolecule through fermentation technology(K3& K6) CO6: Understand the molecular mechanisms underlying central dogma of genetics (K2)
BS020102 **Plant Physiology, Biochemistry and Ecology**	CO1:Correlate chemical makeup and different mechanisms in a cell which makes life possible(K3) CO2:Describe the classification of biomolecules and analyze biochemical properties(K1 &K2) CO3: Illustrate the major plant growth and development mechanisms (K4) CO3:Evaluate the physiological adaptations in a plant for crop improvement.(K3) CO4:Summarize various primary metabolic process in a plant system(K2) CO5: Illustrate the term ecosystem and phytogeography (K2&K3)

BS020103 **Introduction to Traditional and Modern Systems of Medicine**	CO1: Relate the traditional systems of medicine like Ayurveda, naturopathy &Unani(K3) CO2: Summarize the cultivation, collection, processing & importance of various herbal drugs(K2) CO3: Evaluate drug formulations and compare with modern systems of medicine(K5) CO4: Appraise with the concept of Ayurveda pharmacy(K4) CO5:To develop traditional medicine (K6)
BS020104 **Laboratory course I**	CO1:Extend the basic principles of standard solution preparation(K2) CO2:Estimate the amount of polysaccharide, protein and lipids in isolated sample(K5) CO3:Able to cultivate and characterize microorganisms in an aseptic condition(K1)
SECOND SEMESTER	
BS020201 **Principles of Management**	CO1: To identify the general concepts and principles of Management (K1) CO2:To classify various forms of business orgnasisations (K2) CO3: To understand and apply the management theories to resolve management problems (K2 & K3) CO4: To integrate concept in Personnel, Marketing and Financial Management to accomplish management objectives (K4) CO5: To determine the viable recruitment, training marketing and financial strategies (K5) CO6: To design viable recruitment, training marketing and financial strategies (K6)

BS020202 **Medicinal and Aromatic Plants: Conservation, Cultivation and Management**	CO1: Approach the economic importance, uses, botany and harvested processes of the most significant medicinal aromatic and seasoning species plants. (K1) CO2: classification and identification of aromatic plant, seasonings and medicinal plant. (K2) CO3: Critique advanced or novel practical methodologies in the design of quality systems of medicinal herbs (K3) CO4: Analyse the cultivation techniques and formulate effective application of current methodology for problem-solving (K5)
BS020203 **Systematic Botany, Biodiversity and Economic Botany**	CO1:Evaluate classification of plant taxonomy(K5) CO2:Relate the modern approaches in taxonomic studies and identify plants based on their characteristics(K3) CO3: Analyse the role of taxonomy in the conservation of biodiversity(K4) CO4:Identifying morphological peculiarities and explain morphology terminologies(K1) CO5:Summarize the importance of plant products to mankind(K2)
BS020204 **Laboratory course-II**	CO1: Identify medicinal plants, plant morphology and families of flowering plants(K1) CO2: Evaluate soil analysis and Field trial (agrotechnology) for important medicinal plants.(K5) CO3: Analyse the plant species and create herbariums to identify the plant species(K4)

THIRD SEMESTER	
BS020301 **Cell Biology and Biotechnology**	● The course aims at making the students understand the structures and purpose of basic components of prokaryotic and eukaryotic cells. ● The course also aims at acquainting the students with various fields of biotechnology & their application
BS020302 **Phytochemistry**	● The course aims to provide students with the necessary skills for separation of the active constituents obtained from natural sources (alkaloids – glycosides and anticancer drugs) in addition to the different methods of separation (chromatography).
BS020303 **Pharmacognosy**	● This course aims for gaining knowledge about raw drugs and mainly its cultivation , storage and uses.
BS020304 **Laboratory course-III**	● The course is designed to introduce experiments on estimation of fixed oil and alkaloids. ● Study and physical evaluation of crude drugs and collection and submission of raw drug samples.
FOURTH SEMESTER	
ELECTIVES GROUP A	
BS830401 **Research Methodology and Science Communication**	● The course aims to introduce the student to the philosophy of research and accepted methodologies followed in due course and importance and methods of communicating science effectively. ● Also a basic understanding regarding biostatistics is also included.
BS830402 **Product Development, Quality Control and IPR**	● The course is designed to familiarize the students with standard ayurvedic formulations, pharmacopoeia of India and quality control. ● The course also aims at making the students understand the rights that exist to protect the intellectual holders.
	● The course is designed to give the student an overview of plant tissue

BS830403 **Basics of Plant Tissue Culture**	culture which will make her/him appreciate the different techniques involved in the process. • The applications of plant tissue culture for the greater goal of crop improvement.

BS020401 **Laboratory course IV**	● The course is designed to introduce the students to basic techniques in tissue culture and genetic engineering**.**
BS020402 **Research Project & dissertation**	● Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project.
BS020403 **Comprehensive Viva-Voce**	● A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. ● Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students.

MSc FOOD TECHNOLOGY AND QUALITY ASSURANCE	
Course	**Outcome**
FIRST SEMESTER	
FQ010101 **Introduction to Food Science & Technology**	CO1: Elucidate the significant functional roles of organic foods, functional foods, nutraceuticals and speciality foods upon which more advanced and specialized knowledge can be built. (K2) CO2: Summarize the different properties and uniqueness of foods.(K3) CO3: Detail the principles and methods of food preservation and apply scientific methods independently(K4) CO4: Explain flavour chemistry, food toxicology and the utilization of nutraceuticals against various diseases.(K5) CO5: Describe the production process, laws and regulations related to manufacture and export.(K6)
FQ010102 **Basic Biochemistry**	CO1: Explain the classification, structure and functions of biomolecules((K1 &K2) CO2:Analyze and study the biochemical properties of biomolecules(K4) CO3:Explain the various metabolic pathways and its significance in human body(K3) CO4: Articulate the process involved in photosynthesis and its application for the survival of plants(K4) CO5:Relate the type of enzymes and its involvement in various biochemical pathways(K3)

FQ010103 **Food Microbiology**	CO1:Detail basic concept of food microbiology.(K1) CO2: Illustrate various types of food preservation techniques employed in food industries.(K2) CO3: Encapsulate about microbial genetics (K3). CO4: Discuss about microbial spoilage in foods(K4) CO5: Outline about different characteristics of microorganisms seen in food. (K5)
FQ010104 **Food Chemistry**	CO1: To acquaint various functional chemical constituents in food and to determine moisture content and water activity.(K2) CO2: Explain the changes of carbohydrates during processing.(K4) CO3: Summarize the relevance of protein and enzymes in food processing.(K5) CO4: Determine the quality of fats and the changes occur during processing.(K4) CO5: Explain the changes that happen to micronutrients during processing.(K5)
FQ010105 **Biochemistry and Microbiology- Practical I**	CO1: To throw light into various laboratory techniques (K2) CO2: To acquire an elementary knowledge on different principles that are important in the area of Biochemistry & Microbiology.(K3) CO3: Estimation of major macromolecules present in the biological sample qualitative and quantitative methods(K2)

SECOND SEMESTER	
FQ010201 **Food Engineering**	CO1: Explain the units and dimensions of various parameters used for processing food.(K1) CO2: Discuss the mechanism of thermal processing of foods.(K2) CO3: Elaborate on the principle and working of the liquid transport system.(K3) CO4: Describe the principles and methods of refrigeration and freezing.(K4) CO5: Explain the unit operations used in the food industry and to scale up laboratory methods to the manufacturing process.(K6)
FQ010202 **Food Analysis and Instrumentation**	CO1: Describe the Principles underlined in various techniques of food analysis.(K1) CO2: Summarize and apply techniques of carbohydrate analysis.(K2) CO3: Understand and appreciate the analysis techniques of lipids and moisture in food(K3) CO4: Explain the theoretical principles and applications of protein analysis.(K4) CO5: Explain the theoretical principles and applications of analysis of vitamins and minerals(K4)
FQ010203 **Food Preservation Technology**	CO1: Describe the Principles underlined in food spoilage.(K2) CO2: Describe the principles of various methods of food preservation by heat treatment(K3) CO3: Describe the principles of food preservation by low temperature treatment(K4)

	CO4: Learn the effects of preservation by moisture removal(K5) CO5: explain the potential food preservation methods and application of food preservation methods in the food industry.(K6)
FQ010204 **Food Additives & Packaging Technology**	CO1: Discuss the basics on food additives used during food processing.(K2) CO2: Identify the types, merits and demerits of various additives.(K3) CO3: Detail about the materials used for various packaging and explain the testing methods used in packaging.(K4) CO4: Demonstrate different types of Packaging techniques and enumerate the novel packaging technology(K6) CO5: Determine the impact and risk of food adulteration(K5)
FQ010205 **Food Quality Assurance and Management**	CO1: Describe basic concept of Quality control and quality assurance(K1) CO2: Understand the risk assessments procedure for the food sector and explain different methods employed for hazard identification and control(K2) CO3: Explain on pre-requisite programs employed in food industry(K3) CO4: Illustrate various types of quality management systems used in food industries.(K4) CO5: To illustrate the assessment of food quality, hazards impending the food safety and regulation implemented to assure food quality(K6)

FQ010206 **Food Additives & Food Preservation** **Practical II**	CO1: Provide knowledge on various methods used for analysis of additives in food.(K2) CO2: Gain practical skill in packaging (K3) CO3: Evaluate the efficiency of packaging.(K5)
SEMESTER III	
FQ010301 **Technology of Cereals, Pulses and Oil Seeds**	• To provide a deep coverage in the processing and manufacturing of food products from cereals, pulses and oil seeds. • Give a general outline about the principles, structure and composition, economic importance and storage of different cereals and their products
FQ010302 **Technology of Milk, Meat, Poultry and Fish**	• To provide knowledge on the composition, nutritive value and uses of dairy and flesh foods and to broaden and deepen the coverage of production, processing and utilization of each food related to Indian and Continental cuisine.
FQ010303 **Technology of Fruits and Vegetables**	• To provide knowledge on the pre- and post-harvest technology of fresh fruits and vegetables and to introduce the emerging trends in minimal processing of fruits and vegetables.
FQ010304 **Food Analysis-Practical III**	• To provide a knowledge and training on principles and techniques for analysis of food composition
ELECTIVE PAPERS	
ELECTIVE C	
FQ820301 **Sensory Evaluation and Product Development**	• To enlighten the students on the fundamental aspects of sensory science • To provide an updated knowledge on sensory measurements and various sensory factors affecting subjective evaluation

FQ820302 **Food Sanitation and Hygiene**	• To know the principles and applications of sanitation in food industry. • To know about the various types of Sanitation techniques applicable in the food industry • To gain an understanding of food hygiene, sanitation and safety during food processing Unit operations.
FOURTH SEMESTER	
ELECTIVE C	
FQ820403 **By Product Utilization and Waste Management**	• To enlighten the students on the fundamental aspects of sensory science • To provide an updated knowledge on sensory measurements and various sensory factors affecting subjective evaluation
FQ010404 **Food Processing & Sensory Evaluation-Practical IV**	• To know the principles and applications of sanitation in food industry. • To know about the various types of Sanitation techniques applicable in the food industry • To gain an understanding of food hygiene, sanitation and safety during food processing Unit operations.
FQ010405 **Project Evaluation**	• Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project
FQ010406 **Course Viva-Voce**	• A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. • Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students

MSc BIOINFORMATICS	
Course	**Outcome**
SEMESTER 1	
BT010101 **Fundamentals Of Cell Biology And Biochemistry**	CO1:Relate fundamental concepts of cell biology and biochemistry(K2) CO2:Enlist and describe the cell organelles with their molecular and functional organization(K1) CO2:Explain the classification, structure and functions of biomolecules((K1 &K2 CO3:Analyze and study the biochemical properties of biomolecules(K4) CO5: Classify and explain the role of vitamins,enzymes and hormones (K1&K2)
BT010102 **Introduction To Genetics And Molecular Biology**	CO1. Comprehension of basic concepts of the chemical basis of heredity (K1) CO2- Analyse types of methodology in genetics and quantify heritable traits (K2) CO3- Formulate an insight into cellular and molecular mechanisms involved in molecular biology (K3) CO4- Relate the concepts of genetics to the application in bioinformatics (K4)
BT010103 **Fundamentals Of Applied Mathematics And Biostatistics**	C01:.Defining Set Theory, Permutation and combination,Mathematical Induction(K1) CO2:Defining probability theory(K1) CO3:Defining vectors and matrices(K1) CO4:Defining Graph Theory(K1) CO5:Summarizing the basic statistical

	concepts(K2)
BT010104 **Introduction to Computing and Bioinformatics**	C01:To introduce basics of working of a computer in the modern era(K1) CO2:To Articulate nature and scope of Bioinformatics and Biological Data(K2) CO3:To develop skills to create webpages(K6) CO4:To develop skills to create applications program in C (K3)
BT010105 **Laboratory course I**	CO1:To understand and apply methods to evaluate biomolecules(K3) CO2:To develop skills to quantitatively analyze biomolecules(K4) CO3:To develop skills to create webpages(K5) CO4:To develop skills to create applications program in C(K5) CO5:Analyze the unknown biomolecules by applying its properties(K2.K3 &K4)
SEMESTER II	
BT010201 **Metabolism & Enzymology**	CO1:Relate the concepts of Metabolism & Enzymology .(K2 CO2:Discuss the overall concept of cellular metabolism anabolic and catabolic pathways, energy storage and release, production of building blocks for macromolecule synthesis(K6) CO3:Explain the basic concept of Bioenergetics (K2) CO4:Describe structure, functions and mechanism of action of enzymes(K2) CO5::Relate kinetics, inhibition and regulation of enzyme catalysed reactions.(K2)

BT010202 **General Microbiology**	CO1:Detail the basic concepts of microbiology and microbes.(K1) CO2: Explain the various techniques for the growth of microbial samples (K2) CO3: Encapsulate about microbial genetics (K3). CO4: Discuss microbial organisms in diseases and their mechanism of infection (K4) CO5: Outline basic concepts of gene cloning. (K5)
BT010203 **Genomics**	CO1:Discern the crucial concepts and techniques applied in genomics (K2) CO2:Classify the complexity of genome structural and functional organization (K3) CO3:Formulate and assess experimental design for solving theoretical and experimental problems in Genomics(K3) CO4:Extrapolate understanding of genomic data into analytical knowledge(K4)
BT010204 **Bioinformatics & PERL**	CO1:To helps the students, articulate the basic methodologies of Bioinformatics in genomics(K1) CO2:Apply Bioinformatics Skills in molecular phylogeny(K2) CO3:To develop skills in programming languages PERL & BIOPERL(K3) CO4:Articulate Biological databases for retrieving, analysing biological data(K4) CO5:To develop skills to apply bioinformatics tools to understand and managing biological data(K5)

BT010205 **Laboratory course II**	CO1:To impart practical knowledge in students in Basic microbiological techniques(K3) C02:To develop skills in students to identify and characterize bacteria of medical importance(K3) CO3:To develop skills in students to articulate Molecular phylogeny(K4) CO4: To develop application programming skills in students in Perl & Bioperl programming(K6) CO5:To develop practical knowledge in students for Genome analysis tools in Bioinformatics(K4)
SEMESTER III	
BT010301 **Immunology**	● To introduce the basic concepts of Immunology, acknowledge the scope of immune mechanism in life science research and to integrate the scope of Bioinformatics tools in better understanding of immunological approaches.
BT010302 **Proteomics and CADD**	● To introduce basic concepts in Proteomics and their role in Life Science Research, introduce concepts in Computer Aided Drug Design and molecular modeling and signify the role of computational drug discovery methods by providing knowledge on various tools in Bioinformatics.
BT010303 **Database Concepts & Biological Databases**	● To teach concepts in developing & creating databases, introduce programming languages and applying them to create databases and comprehensively understand biological databases.

BT010304 **Advanced Bioinformatics & Linux Operating System**	● To teach advanced topics in Bioinformatics, introduce Free Software; Linux Operation System and working in a command line environment and introduce the concepts of machine learning and their application in Bioinformatics.
BT010305 **Laboratory course III**	● To introduce immunological techniques, Linux programming, SQL commands and php-mysql.

FOURTH SEMESTER	
ELECTIVES GROUP B	
BT810401 **JAVA Programming**	● To teach programming language JAVA, integrate understanding of JAVA in Bioinformatics and apply in database connectivity.
BT810402 **Advanced Genomics**	● To teach advanced concepts for understanding genomes, teach high end sequencing strategies for genomes and learn applications associated with genome analysis.
BT810403 **Research Methodology & Scientific Writing**	● To understand the significance of research methods and learn statistical methods involved in Biological research. ● To teach the fundamentals of scientific writing
BT010401 **Laboratory course IV**	● Students are able to understand isolation techniques, PCR, Java Programming, Python Programming, Drug Design & Docking.
BT010402 **Research Project & Dissertation**	● Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project

BT010403 **Comprehensive Viva –Voce**	● A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. ● Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students

MSc BIONANOTECHNOLOGY	
FIRST SEMESTER	
Course	**Outcome**
BS040101 **Introduction to Cell Biology**	CO1: Enlist and describe the cell organelles with their molecular and functional organization (K1) CO2:Relate fundamental concepts of cell biology(K2) CO3:Critically evaluate the membrane transport systems of organisms(k5) CO4:Analyze the cell signalling between cells and the mechanism of cellular communication((K4) C05:Describe the mechanism involved in cell evolution(K1)
BS040102 **Biomolecules and Metabolism**	CO1:Explain the classification, structure and functions of biomolecules((K1 &K2 CO2:Analyze and study the biochemical properties of biomolecules(K4) CO3:Explain the various metabolic pathways and its significance in human body(K2)

	CO4: Articulate the process involved in photosynthesis(K3) CO5: Classify and explain the role of vitamins,enzymes and hormones (K1&K2)
BS040103 **Genomics and Molecular Biology**	CO1:Comprehension of basic concepts of, fundamentals of genetics, organelle and developmental genetics (K1) CO2:Analyse types of methodology in structural genomics (K2) CO3:Formulate an insight into cellular and molecular mechanisms involved in molecular biology (K3) CO4:Relate the concepts of genetics to the application in bioinformatics (K4) CO5:
BS040104 **Bioanalytical Techniques and Bioinformatics**	CO1:Describe theoretical and technical aspects of various microscopy methods(K1) CO2: Define and describe the principle and methodology of various spectroscopic methods(K2) CO3:Explain the application and methodology of various Chromatographic techniques(K1&K2) CO4:Examine the methods of Electrophoresis and Centrifugation(K1 & K2) CO5: Explain various PCR techniques and microarray(K3) C06:Articulate nature and scope of Bioinformatics, Biological Databases and Bioinformatics tools to explore biological data(K3& K4)

BS040105 **Laboratory Course I**	CO1:To develop basic practical experience in analysis,estimation of different macromolecules,genomics and cytology(K6) CO2:Illustrate preparation of different concentration solutions (K2) CO3:Create skills for Culture, isolation and identification of microbes in immunology and enzymology(K6) CO4:To develop skills to handling basic bioinformatics tools(k6) CO5:Demonstrate the various analytical techniques like chromatography, Spectroscopy& Electrophoresis(K3)
BS040201 **Introduction to Bionanotechnology**	CO1:The students are able to recognize and understand the contributions of various scientists to nanotechnology(K1) CO2:Explain the basics of materials at the nano-scale(K2) CO3:Describe the basic methods used for the synthesis of nanoparticles(K3) CO4:Describe the methods used in characterization of nanoparticles(K4) CO5: Enlist various applications of nanoparticles and evaluate the social and ethical impacts of nanotechnology(K5) CO6: Explain and analyse nano-scale(K5) C07:Devices for photonic, magnetic, mechanical, chemical and biological uses(K4)

BS040202 **Biomimetics & Bionics**	CO1: Describe the confluence of Nanotechnology and Biomimetics(K1&K2) CO2:Explain the basics of biomimetics(K2) CO3:Elucidate bio-inspired materials and machinery required in engineering and biology(K3) CO4:Describe the basic principle and idea behind natures constructions and application of them into technical systems and devices which help in daily life(K2&K3) CO5: Explain basics and history of bionics. (K1&K2) CO6:Demonstrate the basic principles on design, fabrication, control process and social, ethical impacts of bionic systems(K4& K5)
BS040203 **Bionanofabrication& Tissue Engineering**	CO1:Able to gain a foundational knowledge of Nano science and related fields(K1) CO2:Detailed outline about the field of bionanofabrication, as a unique approach for the manufacturing of nanostructures and materials(K2) CO3:Give a broad outline about potential applications of nanomaterials ranging from nanoelectronics,sensor devices to nanomedicine(K1&K2) CO4:Explain the importance and techniques used in plant and animal tissue culture with its significance in tissue engineering(K1,K2& K3) CO5:Describe the role of tissue engineering to assemble functional constructs that restore, maintain, or improve damaged tissues or whole organs(K2&K3)

	CO6:Explain the biomedical applications of nanotechnology with the help of tissue engineering(K3&K4)
BS040204 **Proteomics and Protein Engineering**	C01:Describe the basics of proteomics and protein engineering(K1) C02:Explain extraction, purification and structure-function relationships of proteins(K2) CO3:Explain in detail about synthetic protein structures and functions(K2) C04:Apply protein engineering in food, Medical and Environmental sector(K2 & K3) CO5:Demonstrate various advanced techniques employed in proteomics and protein engineering(K5&K3)
BS040205 **Laboratory Course II**	CO1:Develop a practical knowledge in synthesis of metal, metal oxides, polymer, protein and semiconductor nanoparticles(K2,K4.K5 & K6) CO2:Apply the knowledge on synthesis of nanoparticles(K3) CO3:Verify the nanostructure of synthesized particles using various characterization methods(K3 &K5)
BS040301 **Synthesis,Characterization and Applications of nanomaterials**	● The course is designed to make the student understand various approaches and methods involved in synthesis and characterization of nanomaterials and its applications mainly in therapeutics.

BS040302 **Research Methodology**	● Post graduate courses in general are designed to encourage the students to further their knowledge through research activities. ● The course aims to introduce the student to the philosophy in research and accepted methodologies followed in due course and importance and methods of communicating science effectively. ● Also a basic understanding regarding biostatistics is also included.
BS040303 **Immunology and Molecular Diagnostics**	● The course introduces the student to the field of immunology and then on how human immune system responds to biomaterials and nanoparticles and then envisages to introduce the student to molecular diagnostics and immunotherapeutics.
BS040304 **Nano-Bio interactions**	● The objective of the course is to give the students an in depth understanding about interaction of nanomaterials with cellular components. ● The course is designed to provide an insight into the nano sized components of the cellular system and their functions
BS040305 **Laboratory course III**	● The course is designed to impart a practical knowledge in basic molecular biology techniques and also on methods of characterization of nanomaterials.
FOURTH SEMESTER	
ELECTIVES GROUP A	
Course	**Outcome**
BS890401 **Nanotoxicology**	● The course aims to impart in the student the awareness and understanding the potential for human and environmental exposure, hazard and risk associated with the use and development of nano-structured materials.

BS890402 **Green Nanotechnology**	● At the end of the course, student will be familiar with the field of traditional manufacturing to green manufacturing and also with various processing of sustainable green manufacturing techniques. The course aims at making the students able to improve the knowledge about Industrial ecology
BS890403 **Nanomedicine**	● The course deals with the development and application of materials and devices to study biological processes and to treat disease at the level of single molecules and atoms.
BS040401 **Laboratory course IV**	• This course provides an insight into the fundamentals of nanotechnology in biological and biomedical research. It will also guide the students to understand how nanomaterials can be used for a diversity of analytical and medicinal rationales
BS040402 Research Project & dissertation	• Students will get an opportunity to show the necessary skills and knowledge in order to organise and conduct a research project
BS040403 Comprehensive Viva-Voce	● A comprehensive viva-voce will be held at the end of the fourth semester covering all the courses of the Programme taught in the entire four semesters. ● Students will be evaluated through all core subjects and grade will be awarded on the basis of oral answers given by the students