Bachelor of Computer Applications

Course Outcome (CO) Statements

Batch: 2019 – 20

Bachelor of Computer Applications

Program Outcomes (POs)

- **PO01: Computational Knowledge:** Understand and apply mathematical foundation, computing and domain knowledge for the conceptualization of computing models from defined problems.
- **PO02: Problem Analysis:** Ability to identify, critically analyze and formulate complex computing problems using fundamentals of computer application domains.
- **PO03: Design/ Development of Solutions:** Ability to transform complex business scenarios and contemporary issues into problems, investigate, understand and propose integrated solutions using emerging technologies.
- **PO04: Conduct Investigations of Complex Computing Problems:** Ability to devise and conduct experiments, interpret data and provide well informed conclusions.
- **PO05: Modern Tool Usage:** Ability to select modern computing tools, skills and techniques necessary for innovative software solutions.
- **PO06: Professional Ethics:** Ability to apply and commit professional ethics and cyber regulations in a global economic environment.
- **PO07: Life-long Learning:** Recognize the need for and develop the ability to engage in continuous learning as a Computing professional.
- **PO08: Project Management:** Ability to understand management and computing principles with computing knowledge to manage projects in multidisciplinary environments.
- **PO09: Communication Efficacy:** Communicate effectively with the computing community as well as society by being able to comprehend effective documentations and presentations.
- **PO10: Societal & Environmental Concern:** Ability to recognize economical, environmental, social, health, legal, ethical issues involved in the use of computer technology and other consequential responsibilities relevant to professional practice.
- **PO11: Individual and Team Work:** Ability to work as a member or leader in diverse teams in multidisciplinary environment.
- **PO12: Innovation and Entrepreneurship:** Identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.

PROGRAM SPECIFIC OUTCOMES (PSO)

BCA Regular

- **PSO1:** Pertain current knowledge and adapting to emerging applications of Mathematics, Science fundamentals in the field of Computer science and its applications.
- **PSO2:** Exhibit proficiency in identifying, formulating and analyzing complex problems in the computer environment.
- **PSO3:** Ability to create, select and apply appropriate modern techniques for solving complex issues.
- **PSO4:** Explore technical knowledge in diverse areas of Computer Applications and experience a conductive environment in nurturing skills for successful carrier and higher studies.

Cloud Technology and Information Security (CTIS)

- **PSO1:** Explore the impact of cloud and security in a global scenario and be a successful computer professional**.**
- **PSO2:** Apply the knowledge of cyber-crime and cyber security.
- **PSO3:** Design and apply the suitable techniques, resources, modern methods, tools and technology to solve complex problems.
- **PSO4:** Inculcate professional and ethical principles.

Information Security and Mobile Applications (ISMA)

- **PSO1:** Explore and analyse the basics of Information Security and Android Development framework.
- **PSO2:** Design and analyse the user interfaces based on the specifications.
- **PSO3:** Recognise the need to use different packages and hardware resources to design a given application.
- **PSO4:** Enterprise and develop high-end mobile applications by considering security aspects.

Mobile Applications and Cloud Technology (MACT)

- **PSO1:** Apply the basic knowledge of Cloud Computing and Android Technology.
- **PSO2:** Analyse and adopt the knowledge on various cloud and mobile service providers.
- **PSO3:** Acclimate and apply latest tools, techniques and resources to various cloud and mobile computing activities.

- **PSO4:** Design and develop solutions for real-time problems in Mobile Applications and Cloud Technology.

Internet of Things (IoT)

- **PSO1:** Recognize and explore the basics of Internet of Things.
- **PSO2:** Identify and apply the new trends in the field of technology pertaining to IoT.
- **PSO3:** Inculcate the knowledge gained and design a solution in a multi-disciplinary approach over a broader social context.
- **PSO4:** Explore strong skills on sensor networks, IoT devices and systems.

Data Analytics (DA)

- **PSO1:** Design, implement, populate and query the relational databases for operational data.
- **PSO2:** Import and evaluate a very large data sets to make business decisions.
- **PSO3:** Execute real time analytical methods on streaming data sets to react quickly to customer needs.
- **PSO4:** Mine data and carry out predictive modelling and analytics to support business decision making.

Artificial Intelligence

- **PSO 1: Analytical Thinking -** Identify, formulate and solve Artificial Intelligence problems by applying mathematical foundations and algorithmic principles to meet industrial challenges and needs.
- **PSO 2: Principles of Information Technology -** Analyze, design and develop AI based Software, Multimedia, Web applications and Networking technologies for an efficient design of AI based systems with high professional skills.
- **PSO 3: Ethics -** Understand best practices, ethical standards and replicate the same for the industry, research and societal needs.

Cyber Security

- **PSO 1: Analytical Thinking -** Identify, formulate and solve Cyber Security based problems by applying processes and secure algorithmic principles in various computing environments to meet industrial challenges.
- **PSO 2: Principles of Information Technology -** Analyze, design and develop Solutions, Software, Applications and Networking technologies for an efficient and secure design of systems with high professional skills.
- **PSO 3: Ethics -** Understand best practices, ethical standards and replicate the same for the industry, research and societal needs.

COURSE OUTCOMES (COs)

BCA REGULAR

2019-20 Batch

Semester	Course Code	Course Name	Course Outcomes (COs)
I	**20BCA1C03**	**Fundamentals Of Mathematics**	**CO 1 :** Apply the concept of Mathematical Logics. **CO 2:** Use concept of Matrices and Determinants. **CO 3:** Apply the concept of Mathematical Logics. **CO 4:** Solve the problems using concepts of Set theory. **CO 5:** Illustrate the implementation of Permutation and Combination
	20BCA1C04	**Computer Fundamentals & Organization**	**CO 1:** Identify the concepts and applications of computers. **CO 2:** Use of computer architecture and its languages efficiently. **CO 3:** Identify the importance of internal organization of computer and problem solving aspects. **CO 4**: Illustrate the networking of computers and IPR concepts. **CO 5**: Design the static webpage and use MS Office efficiently.
	20BCA1C05	**Programming In C**	**CO 1**: Analyse the algorithm and illustrate problem using flowchart. **CO 2:** Apply the concepts of an arrays in real time applications. **CO 3:** Use the functions for various problems. **CO 4:** Solve the problems using pointers and structures. **CO 5:** Illustrate the basic file operations.
	20BCA1C06	**Introduction To Linux**	**CO1**: Explore the basic LINUX commands with its architecture. **CO2:** Use LINUX file system and different system calls in files. **CO3:** Analyze the working of processes in LINUX operating system. **CO4:** Demonstrate the simple shell scripting with VI editor. **CO5:** Use the system administrative skills in Linux operating system.

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II	**20BCA2C03**	**Operating Systems**	**CO 1:** Explore the fundamental components of a computer operating system. **CO 2:** Compare and recommend various scheduling algorithms for processes, and solve the deadlock problems. **CO 3:** Recommend the requirement of process synchronization and coordination handled by OS. **CO 4:** Analyze the memory management schemes. **CO 5:** Identify and compare the security and protection mechanisms related to an OS.
	20BCA2C04	**Object Oriented Programming With C++**	**CO 1:** Explore the features of concepts in object-oriented programming. **CO 2:** Apply the concepts like class, object and functions in basic programs. **CO 3:** Identify the use of operator overloading and apply inheritance concept for basic problems. **CO 4:** Illustrate the concepts of pointers and virtual functions. **CO 5:** Apply and relate the file operations concepts and its functionalities.
	20BCA2C05	**Data Structures Using C**	**CO 1**: Analyze algorithms and algorithm correctness. **CO 2**: Apply the searching and sorting techniques in real time applications. **CO 3**: Explore concepts on stack and queue operation and its implementation. **CO 4**: Adopt the knowledge of linked list on node of array. **CO 5**: Apply the concepts of trees and its applications.
III	**16BCA3C01**	**Fundamentals Of Information Security**	**CO1** : Explain basic principles, critical concepts of Informatin Security, System Development life cycle **CO2** : Summarize the concepts related to data protection and safe guarding of assets, various threats and attacks **CO3:** Classify and analyze the different risk mitigation strategy options, risk controls, process of risk assessment **CO4:** Illustrate and examine the need of Intrusion detection and prevention systmes - Firewall, Network security policies

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	16BCA3C02	**Relational Database Management System (Rdbms)**	**CO 1:** Explain the basic concept of DBMS, its advantages and applications and to summarize the role of different database users **CO 2**:Illustrate ER - diagram notations for developing the logical design of the database, and to show the conversion of logical design to relational table **CO 3** :Evaluate the different SQL queries on database to create and manipulate relational database, and to illustrate relational algebra **CO 4** :Apply different normalisation techniques on the database by applying the concept of functional dependency/decomposition. **CO 5** :Analyse the concept of transaction processing, discuss different locking protocols and deadlock and recovery management, determine the view and conflict serializability of given schedule.
	16BCA3C03	**Computer Networks**	**CO 1** : Describe the functions of each layer in OSI and TCP/IP model. **CO 2** : Explain the network devices and Wireless networking components. **CO 3**: Classify the network routing protocols and analyze how to assign the IP addresses for the given network as well as describe the application layer. **CO 4:** Illustrate the WAN technology and to model the Network operating systems and trouble shooting network.
	16BCA3C04	**Programming In Java**	**CO 1:** Demonstrate Clear understanding of Object Oriented Programming paradigm **CO 2:** Demonstrate the Understanding of simplicity, type safe and modularity concepts of Java **CO 3:** Students will be able to develop a model web programming using Applet and developing the interface. **CO 4:** Apply Concept of multi-tasking through Thread/Multi-threading and learning the systems calls of JVM **CO 5:** Illustrate the Query processing through Java Programming and Understanding of Database and integration with JDBC

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IV	**16BCA4C01**	**Discrete Mathematics & Statistics**	**CO1:** Ability to apply properties of groups, subgroups, cyclic groups, group codes, decoding and hamming matrix to solve problems. And proof of Lagrange's theorem. **CO2:** Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, mathematical induction, the pigeon-hole principle, and binomial expansion. **CO3:** Ability to apply Solving problems on closure, transitive, hasse diagrams, Warshall's algorithm and partial ordering to solve problems. **CO4:** Understand vector addition and scalar multiplication, algebraically. **CO5:** Application of statistics to various fields, Classification and tabulation of data theoretically and graphically with examples, Location of mode using histogram and median.
	16BCA4C02	**Web Technology**	**CO1:** Explain the concepts of client server communications and markup languages. **CO2:** Designing style sheets with its properties along with client side programming. **CO3:** Illustrate the Document object model. **CO4:** Analyze basics of JQuery. **CO5:** Understand the server side scripting and JSP technology.
	16BCA4D31	**Enterprise Application Development**	**CO1:** Explain the Enterprises Architecture Life Cycle and its Models. **CO2:** Explain the concept of client server model and learn servlet and jsp. **CO3:** Understand enterprise information systems, JPA, JTA. **CO4:** Discuss about EJB, JAX-WS and MVC model. **CO5:** Describe about enterprise mobility and various architectures.
	16BCA4D32	**Data Warehouse and Data Mining**	**CO1 :** Explain the concepts of data warehousing. **CO2 :** Explain the project requirements, planning and management. **CO3:** Understand data desing and OLAP. **C04:** Describe about applications and trends in data mining.

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V	**16BCA5D11**	**Analysis And Design Of Algorithms**	**CO1:** Understand the basics about the algorithm , notations and correctness . **CO2:** Analyse the Paradigm and design techniques with respect sorting **CO3:** Adopt the technique for traverse in graphs to solve the efficient path. **CO4:** Apply dynamic programming in optimizing problem and combining the solutions of subprograms . **CO5:** Analyse the Paradigm based on heurstic and to find the optimal solution .
	16BCA5D12	**Computer Graphics**	**CO1:** Understand the basics of computer graphics fundamentals . **CO2:** Analyse the algorithm properties of basics of drawing . **CO3:** Adopt the algorithm related to the coordiante the system and clipping operations . **CO4:** Interpret the Detection Methods & Illumination Model. **CO 5:** Understand the basics of multimedia and huffmann coding .
	16BCA5D21	**.Net Technology**	**CO1:** Understand the basics of .Net framework **CO2:** Analyse how to apply advance web controls **CO3:** Analyse the structure and binding the data in database **CO4:** Adopt the accesing the data in database. **CO5:** Interpretation of the security aspect with respect to sessions and cookies .
	16BCA5D22	**Linux Administration**	**CO1:** Understand the Linux operating system basics. **CO2:** Analyse basics operations on the File system. **CO3:** Adopt the techniques for configuartion of the system. **CO4:** Analyse the configuration methods on the filesystem. **CO5:** Interpretation of protocols related to linux security.
	16BCA5S31	**Software Engineering**	**CO1**: Understand the Basics of Software Engineering fundamentals. **CO2:** Understand the various requirement of Software. **CO3:** Analyse the concepts of designing and software system. **CO4:** Analyse the testing and debugging strategy. **CO5:** Analyse the concepts of software project management.

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	16BCA5S41	**Interactive Web Application**	**CO1:** Introduction of Scripting language **CO2:** Analyse various datatypes variables and functional programming **CO3:** Understand and Analyse the basic jQuery library **CO4:** Adopt the Windows, Frames and Overlay in JavaScript **CO5:** Implement various applications in AJAX.
	16BCA5S42	**User Interface And User Experience**	**CO1:** Understand the basics of User interface and user experience **CO2:** Understand the Software life cycle **CO3:** Understand the User Interface designs and various strategies **CO4:** Adopt the Best Practices In Ui Design **CO5:** Analyse case studies related to User Interface and user experience.

VI	**16BCA6D11**	**Cloud Computing**	**CO1 :** Learn the basics of cloud technology in Windows Azure service. **CO2 :** Implement storage in cloud. **CO3**:Implement database set up in Azure.
	16BCA6D12	**Software Testing**	**CO1:**Learn Various test processes and continuous quality improvement **CO2:**Understand types of errors and fault models **CO3:** Implement methods of test generation from requirements **CO4:** Input space modeling using combinatorial designs
	16BCA6S21	**Object Oriented Analysis And Design And Unified Modeling Language**	**CO1:** Analyze information systems in real-world settings and to conduct methods such as interviews and observations. **CO2:** Develop a general understanding of a variety of approaches and perspectives of systems development. **CO3:** Evaluate other IS development methods and techniques know techniques aimed to achieve the objective and expected results of a systems development process. **CO4:** Understand different types of prototyping know how to use UML for notation.
	16BCA6S22	**Tools In Data Analytics**	**CO1:** Understand the important concepts related to data analytics. **CO2:** Apply different statistical techniques in testing hypothesis and regression analysis **CO3:** Understand the importance of statistics in data analytics **CO4:** Understand the R working Environment with R studio. **CO5:** Understand the basic concepts of statistical functions in R for the Data analytics

CLOUD TECHNOLOGY AND INFORMATION SECURITY (CTIS)

2019-20 Batch

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IV	**16BCA4CC01**	**Ethical Hacking Fundamentals**	**CO1 :** Learn Introduction to ethical Hacking, Enumeration and System Hacking **CO2 :** Implement Hacking Methodology with Sniffers, DoS and web Hacking **CO3:** Identify Wireless Network Security and Physical Security measures **CO4:** Generate Report writing & Mitigation of Vulnerabilities
	16BCA4CC02	**Network Security**	**CO1:** Understand the power of computers can be witnessed when multiple computers are connected to form a network and start sharing information amongst them. **CO2:** Knowledge about threats due to many users who log into these networks and their environments. **CO3:** Learn about Network Security, in order to safeguard our networks from hackers and damages

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	19BCA42D31	**Virtualization And Cloud Technology**	**CO1:** Explain the basic concepts and terminology of virtualization and cloud technologies in current IT environment. **CO2:** Examine and Describe the functions of Virtualization and deploy the concepts of virtualization technologies along with managing the virtual machines. **CO3:** Classify and Analyse the terms of Cloud computing and its models along with services, types and challenges with cloud applications. **CO4:** Illustrate and Examine the Azure Basics, Services, Portals, Management and Virtual Machine Management. **CO5:** Describe the basic concepts of Amazon Web Services and Comparison of AWS and Azure, AWS Billing and AWS Virtual Machine.
	19BCA423D32	**Configuration Of Server**	**CO1:** Ability to explain various editions, features and installation process of windows server 2012/2012r2. **CO2:** explain the storage technologies and RAID levels to configure storage spaces for server. **CO3:** Able to understand NTFS permissions for share and access the files. **CO4:** Ability to configure print server with various printer and able to work on remote management tools. **CO5:** Ability to create virtual machines and control VMs storage using Hyper-V manager.
	16MATH0G1	**Elements of Discrete Mathematics**	**CO1:** Ability to apply properties of groups, subgroups, cyclic groups, group codes, decoding and hamming matrix to solve problems. And proof of Lagrange's theorem. **CO2:** Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, mathematical induction, the pigeon-hole principle, and binomial expansion. **CO3:** Ability to apply Solving problems on closure, transitive, hasse diagrams, Warshall's algorithm and partial ordering to solve problems. **CO4:** Understand vector addition and scalar multiplication, algebraically **CO5:** Apply the concept of group codes, decoding and hamming matrix to solve

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	16MATH0G2	**Elements of Probability & Statistics**	**CO1:** Ability to apply the statistics in different research areas. **CO2:** Ability to solve problem associate to the real life issues by using probability theory. **CO3:** Ability to solve problem associate to the real life issues by using probability addition and multiplication theorem. **CO4:** Implement the probability concept in data science. **CO5:** Implies the correlation and regression theory concept in data mining.
V	**16BCA5CD11**	**Computer Forensic And Investigation**	**CO1 :** Computer Forensics Basics and Case Studies **CO2 :** Learn about Storage Devices and Data Acquisition Methods **CO3:**Apply Forensic Techniques with respect to different Operating Systems **CO4:** Analysing social networks and email investigation. **CO5:** Understanding various cyber laws and its sections, guidelines for forensic report writing.
	16BCA525D21	**Storage Management**	**CO1:** A good knowledge of data storage techniques using various storage topologies and their comparisons. **CO2:** Will provide the students to choose the best suitable data storage method for their programs and applications. **CO3:** Implementation of RAID software and understanding its impact. **CO4:** Introduction to business continuity and backup procedures. **CO5:** Preserving data consistency in a file system.
	16BCA525D22	**Remote Infrastructure Management Services**	**CO1 :** Identify and describe the business drivers and components along with its benefits of RIMS. **CO2 :** Explain the Outsourcing models and the need for Global outsourcing. **CO3:** Define a plan for RIM Services and have clear understanding of the processes. **CO4:** Implement the various support activities, manage and monitor the implemented RIM Services.
	16BCA56CS31	**Disaster Recovery And Business Continuity Management**	**CO1:** Understand the importance of disaster recovery and give importance to the Testing, Maintenance and Training process. . **CO2:** Identify a wide variety of testing process that involves full interruption, walk through, and Check listing, Simulation and Parallel **CO3:** BCP awareness and training

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	16BCA5CS32	**Management Of Data Centers**	**CO1:** Importance of data centers and their need. **CO2:** Understand the requirements for a data center. **CO3**: Learn aspects that have to be considered while designing a datacentre
	16BCA5CS41	**It Governance, Risk And Information Security Management**	**CO1:** Understand the role of IT Governance and best practices that are used in the IT companies. **CO2:** Develop a risk management program within the framework of ISACA **CO3:** Develop a risk management plan for project **CO4:** Assess the risk plan developed
	16BCA52S42	**Cobit, Valit, Risk It**	**CO1:** Understand to control requirements, technical issues and business risks, their business perspective. **CO2:** Students will learn how the Principles and Processes are connected to ISG **CO3:** Developing Risk Management Program and Decision Making **CO4:** Performance Optimisation of COBIT and other frameworks.
VI	**16BCA6CD11**	**Windows Azure**	**CO1:** Understand basics of cloud technology in Windows Azure services like computer service, network service, data service and App service. **CO2:** Implement Windows Azure services of Azure storage basics **CO3:** Implement Windows Azure Networking **CO4:** Windows Azure services like Azure Websites
	16BCA62S31	**Cloud Web Services**	**CO1:** Ability to explain various services provided by Amazon cloud and deployment models **CO2:** To explain the elastic compute instances and load balancing operations **CO3:** Able to understand web application and security with system management options **CO4:** Discover different storage options and conceptualization of Amazon. **CO5:** Ability to configure virtual private cloud with different cases
	16BCA623S32	**IT Infrastructure Library**	**CO1:** Understand overview and service strategy of ITIL **CO2:** Implement service design of ITIL **CO3:** Assess service transition of ITIL **CO4:** Understand Service Operation, Continual Service .Improvement of ITIL **CO5:** Develop strategies for Continual Service Improvement of ITIL

INFORMATION SECURITY AND MOBILE APPLICATIONS (ISMA)

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	16BCA3C04	**Programming In Java**	**CO 1:** Demonstrate Clear understanding of Object Oriented Programming paradigm **CO 2:** Demonstrate the Understanding of simplicity, type safe and modularity concepts of Java **CO 3:** Students will be able to develop a model web programming using Applet and developing the interface. **CO 4:** Apply Concept of multi-tasking through Thread/Multi-threading and learning the systems calls of JVM **CO 5:** Illustrate the Query processing through Java Programming and Understanding of Database and integration with JDBC
IV	**16BCA4CC01**	**Ethical Hacking Fundamentals**	**CO1** : Learn Introduction to ethical Hacking, Enumeration and System Hacking **CO2** : Implement Hacking Methodology with Sniffers, DoS and web Hacking **CO3:** Identify Wireless Network Security and Physical Security measures **CO4:** Generate Report writing & Mitigation of Vulnerabilities.
	16BCA4CC02		**CO1:** Explain the Overview and Need of Network Security along with various features of Network Security. **CO2:** Explain the Overview and Need of Network Security along with various features of Network Security. **CO3:** Describe the concept of Secure Socket Layer and Various VPN Technologies along with Cryptographic Methods. **CO4:** State how the Intrusion Detection/Prevention system IDS, IPS be used for identifying any network intrusions & the concept of anomaly detection. **CO5:** Enumerate the best practices, techniques and methodologies for information security management and elaborate on some case studies related to network security.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA4CD31	**Android Operating System**	**CO1:** Learn android operating system component and usage. **CO2:** Design android operating system component and usage. **CO3:** Recognize how the Content is provided and managed in AOS. **CO4:** Construct application to play music and find current location. **CO5:** Develop mobile application and publish in google play store.
	16BCA4CD32	**Mobile Architecture And App Development**	**CO1:** Explain the basic concepts and terminology of mobile network, principles, protocols, architecture and cellular based network **CO2:** Examine and Describe the functions of Mobile device architecture, Power management, Mobile hardware and software components **CO3:** Classify and Analyse the terms of Mobile Application Development, Mobile Programming practies in real time and mobile services **CO4:** Describe the terminologies of Mobile Web based Application, Mobile Programming Tools, Development Mobile Apps **CO5:** Illustrate and Examine the Concepts of Mobile Operating system and its types.
	16MATH0G1	**Elements Of Discrete Mathematics**	**CO1:** Ability to apply properties of groups, subgroups, cyclic groups, group codes, decoding and hamming matrix to solve problems. And proof of Lagrange's theorem. **CO2:** Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, mathematical induction, the pigeon-hole principle, and binomial expansion. **CO3:** Ability to apply Solving problems on closure, transitive, hasse diagrams, Warshall's algorithm and partial ordering to solve problems. **CO4:** Understand vector addition and scalar multiplication, algebraically. **CO5:** Apply the concept of group codes, decoding and hamming matrix to solve problems.
	16MATH0G2	**Elements Of Probability & Statistics**	**CO1:** Apply the statistics in different research areas. **CO2:** Solve problem associate to the real life issues by using probability theory. **CO3:** Solve problem associate to the real life issues by using probability addition and multiplication theorem. **CO4**: Implement the probability concept in data science. **CO5:** Imply the correlation and regression theory concept in data mining.

Semester	Course Code	Course Name	Course Outcomes (COs)
V	**16BCA5CD11**	**Computer Forensic And Investigation**	**CO1 :** Understand Computer Forensics Basics and Case Studies **CO2 :** Storage Devices and Data Acquisition Methods **CO3:** Compare Forensic Techniques with respect to different Operating Systems **CO4:** Forensic Techniques for analysing social networks and email investigation. **CO5:** Understanding various cyber laws and its sections, guidelines for forensic report writing.
	16BCA54D12	**Android Security**	**CO1:** Learn Android Security Basics and sandboxing environment **CO2:** Different security frameworks **CO3:** Different Vulnerabilities of Android **CO4:** Various Exploits of Android **CO5:** Understanding various Android Security attacks
	16BCA5CD21	**Advanced Web Technology**	**CO1:** Learn the HTML5 Basics **CO2:** Identify Different HTML5 features **CO3:** Learn the usage of Different Multimedia aspects and API **CO4:** Ability to work on various Canvas and storage options **CO5:** Learn the usage of various Geolocation APIs and method
	16BCA5CD22	**Mobile Application Development**	**CO1:** Usage of mobile devices have increased exponentially over the past decade. Most of the people have more than one mobile devices. **CO2:** Learn new mobile technologies and standards. **CO3:** Understand the basics of mobile network, device and their architecture. **CO4:** Understand the importance, features, functions and types of mobile operating systems. **CO5:** Implementing various communication network protocol.
	16BCA5S31	**Software Engineering**	**CO1:** Learn the basics of software product and SDLC life cycle **CO2:** Understand the different concepts of software requirements and prototyping **CO3**: Identify and incoporate different analysis and design concepts **CO4:** Perform various testing strategies **CO5:** Create projects based on reputed project management models

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA5CS32	**Mobile Value Added Services**	**CO1:** Learn the basics of Mobile value added services **CO2:** Understand the different types of value added services **CO3:** Explore different types of content based service **CO4:** Learn the basics of interactive web **CO5:** Create simple projects based on javascript object model
	16BCA5CS41	**It Governance, Risk And Information Security Management**	**CO1:** Learn the basics of IT Governance **CO2:** Understand the different responsibilities and frameworks of IT governance **CO3:** Explore the importance of System Strategy and planning **CO4:** Learn various risk management methods **CO5:** Design standards, processes of information security management
	16BCA54S42	**Cloud Security**	**CO1**: Learn the basics of virtualization and cloud concepts **CO2**: Understand the different cloud security vulnerabilities and controls **CO3**: Explore the importance of various cloud trust protocols & its transparency with privacy and compliance **CO4**: Learn various cloud data security **CO5**: Understand various legal challenges of cloud and concepts of IPR
VI	**16BCA6ID11**	**Mobile, Wireless And Voip Security**	**CO1 :** Learn about different Networking concept **CO2 :** Ablility to keep data secured in Wireless environment **CO3:** Secure data in VoIP environment **CO4:** Secure data in Bluetooth environment **CO5:** Work on mobile application development security
	16BCA6ID12	**Cyber Forensic**	**CO1:** To be familiar with knowledge of forensic techniques and understand how to apply them in different scenarios **CO2:** To be proficient with use of various tools in doing forensic analysis of different platforms **CO3:** To be able to connect forensic evidences to deduce usable and meaningful inferences **CO4:** Analyze need and importance of Linux operating system **CO5:** Test current trends and tools

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA6CS31	**Mobile Ecosystem And Business Models**	**CO1:** Impart knowledge of ecosystem and business model **CO2:** Develop student's understanding in mobile ecosystem **CO3:** Discuss various business models followed by the mobile industry **CO4:** Learn mobile marketing model and apply them **CO5:** Learn mobile gaming model for business and apply them
	16BCA6CS32	**MOBILE TESTING**	**CO1:** Impart knowledge of ecosystem and business model **CO2:** Develop student's understanding in mobile ecosystem **CO3:** Discuss various business models followed by the mobile industry **CO4:** Learn mobile marketing model and apply them **CO5:** Learn mobile gaming model for business and apply them

MOBILE APPLICATIONS AND CLOUD TECHNOLOGY (MACT)

2019-20 Batch

Semester	Course Code	Course Name	Course Outcomes (COs)
I	**20BCA1C03**	**Fundamentals Of Mathematics**	**CO 1 :** Apply the concept of Mathematical Logics. **CO 2:** Use concept of Matrices and Determinants. **CO 3:** Apply the concept of Mathematical Logics. **CO 4:** Solve the problems using concepts of Set theory. **CO 5:** Illustrate the implementation of Permutation and Combination
	20BCA1C04	**Computer Fundamentals & Organization**	**CO 1:** Identify the concepts and applications of computers. **CO 2:** Use of computer architecture and its languages efficiently. **CO 3:** Identify the importance of internal organization of computer and problem solving aspects. **CO 4**: Illustrate the networking of computers and IPR concepts. **CO 5**: Design the static webpage and use MS Office efficiently.
	20BCA1C05	**Programming In C**	**CO 1**: Analyse the algorithm and illustrate problem using flowchart. **CO 2:** Apply the concepts of an arrays in real time applications. **CO 3:** Use the functions for various problems. **CO 4:** Solve the problems using pointers and structures. **CO 5:** Illustrate the basic file operations.
	20BCA1C06	**Introduction To Linux**	**CO1**: Explore the basic LINUX commands with its architecture. **CO2:** Use LINUX file system and different system calls in files. **CO3:** Analyze the working of processes in LINUX operating system. **CO4:** Demonstrate the simple shell scripting with VI editor. **CO5:** Use the system administrative skills in Linux operating system.
II	**20BCA2C03**	**Operating Systems**	**CO 1:** Explore the fundamental components of a computer operating system. **CO 2:** Compare and recommend various scheduling algorithms for processes, and solve the deadlock problems. **CO 3:** Recommend the requirement of process synchronization and coordination handled by OS. **CO 4:** Analyze the memory management schemes. **CO 5:** Identify and compare the security and protection mechanisms related to an OS.

Semester	Course Code	Course Name	Course Outcomes (COs)
	20BCA2C04	**Object Oriented Programming With C++**	**CO 1:** Explore the features of concepts in object-oriented programming. **CO 2:** Apply the concepts like class, object and functions in basic programs. **CO 3:** Identify the use of operator overloading and apply inheritance concept for basic problems. **CO 4:** Illustrate the concepts of pointers and virtual functions. **CO 5:** Apply and relate the file operations concepts and its functionalities.
	20BCA2C05	**Data Structures Using C**	**CO 1**: Analyze algorithms and algorithm correctness. **CO 2**: Apply the searching and sorting techniques in real time applications. **CO 3**: Explore concepts on stack and queue operation and its implementation. **CO 4**: Adopt the knowledge of linked list on node of array. **CO 5**: Apply the concepts of trees and its applications.
III	**16BCA3C01**	**Fundamentals Of Information Security**	**CO1** : Explain basic principles, critical concepts of Informatin Security, System Development life cycle **CO2** : Summarize the concepts related to data protection and safe guarding of assets, various threats and attacks **CO3:** Classify and analyze the different risk mitigation strategy options, risk controls, process of risk assessment **CO4:** Illustrate and examine the need of Intrusion detection and prevention systmes - Firewall, Network security policies
	16BCA3C02	**Relational Database Management System (Rdbms)**	**CO 1:** Explain the basic concept of DBMS, its advantages and applications and to summarize the role of different database users **CO 2**:Illustrate ER - diagram notations for developing the logical design of the database, and to show the conversion of logical design to relational table **CO 3** :Evaluate the different SQL queries on database to create and manipulate relational database, and to illustrate relational algebra **CO 4** :Apply different normalisation techniques on the database by applying the concept of functional dependency/decomposition. **CO 5** :Analyse the concept of transaction processing, discuss different locking protocols and deadlock and recovery management, determine the view and conflict serializability of given schedule.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA3C03	**Computer Networks**	**CO 1** : Describe the functions of each layer in OSI and TCP/IP model. **CO 2** : Explain the network devices and Wireless networking components. **CO 3**: Classify the network routing protocols and analyze how to assign the IP addresses for the given network as well as describe the application layer. **CO 4:** Illustrate the WAN technology and to model the Network operating systems and trouble shooting network.
	16BCA3C04	**Programming In Java**	**CO 1:** Demonstrate Clear understanding of Object Oriented Programming paradigm **CO 2:** Demonstrate the Understanding of simplicity, type safe and modularity concepts of Java **CO 3:** Students will be able to develop a model web programming using Applet and developing the interface. **CO 4:** Apply Concept of multi-tasking through Thread/Multi-threading and learning the systems calls of JVM **CO 5:** Illustrate the Query processing through Java Programming and Understanding of Database and integration with JDBC
IV	**19BCA45C01**	**Configuration Of Server**	**Co1 :** Ability to explain various editions, features and installation process of windows server 2012/2012r2. **Co2 :** To explain the storage technologies and raid levels to configure storage spaces for server. **Co3:** Able to understand ntfs permissions for share and access the files. **Co4:** Ability to configure print server with various printer and able to work on remote management tools. **Co5:** Ability to create virtual machines and control vms storage using hyper-v manager.

Semester	Course Code	Course Name	Course Outcomes (COs)
	19BCA45C02	**Virtualization And Cloud Technology**	**Co1:** Explain the basic concepts and terminology of virtualization and cloud technologies in current it environment. **Co2:** Examine and describe the functions of virtualization and deploy the concepts of virtualization technologies along with managing the virtual machines. **Co3:** Classify and analyse the terms of cloud computing and its models along with services, types and challenges with cloud applications. **Co4:** Illustrate and examine the azure basics, services, portals, management and virtual machine management. **Co5:** Describe the basic concepts of amazon web services and comparison of aws and azure, aws billing and aws virtual machine.
	16BCA4CD31	**Android Operating System**	**Co1:** Learn android operating system component and usage **Co2:** Explain ui component and layouts **Co3:** Recognize how the content is provided and managed in aos **Co4:** Construct application to play music and find current location **Co5:** Develop mobile application and publish in google play store
	16BCA4CD32	**Mobile Architecture And App Development**	**Co1:** Explain the basic concepts and terminology of mobile network, principles, protocols, architecture and cellular based network **Co2:** Examine and describe the functions of mobile device architecture, power management, mobile hardware and software components **Co3:** Classify and analyse the terms of mobile application development, mobile programming practies in real time and mobile services **Co4:** Describe the terminologies of mobile web based application, mobile programming tools, development mobile apps **Co5:** Illustrate and examine the concepts of mobile operating system and its types.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16MATH0G1	**Elements Of Discrete Mathematics**	**Co1:** Ability to apply properties of groups, subgroups, cyclic groups, group codes, decoding and hamming matrix to solve problems. And proof of lagrange's theorem. **Co2:** Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, mathematical induction, the pigeon-hole principle, and binomial expansion. **Co3:** Ability to apply solving problems on closure, transitive, hasse diagrams, warshall's algorithm and partial ordering to solve problems. **Co4:** Understand vector addition and scalar multiplication, algebraically. **Co5:** Apply the concept of group codes, decoding and hamming matrix to solve problems.
	16MATH0G2	**Elements Of Probability&Statistics**	**Co1:** Ability to apply the statistics in different research areas. **Co2:** Ability to solve problem associate to the real life issues by using probability theory. **Co3:** Ability to solve problem associate to the real life issues by using probability addition and multiplication theorem. **Co4:** Implement the probability concept in data science. **Co5:** Imply the correlation and regression theory concept in data mining.
V	**16BCA525D21**	**Storage Management**	**Co1 :** Understand data storage techniques using various storage topologies and their comparisons **Co2 :** Choose the best suitable data storage method for their programs and applications. **Co3:** Implementation of raid software and understanding its impact. **Co4:** Introduction to business continuity and backup procedures. **Co5:** Preserving data consistency in a file system
	16BCA525D22	**Remote Infrastructure Management Services**	**Co1:** Identify and describe the business drivers and components along with its benefits of rims. **Co2:** To explain the outsourcing models and the need for global outsourcing. **Co3:** Define a plan for rim services and have clear understanding of the processes. **Co4:** Implement the various support activities, manage and monitor the implemented rim services. **Co5:** Able to work with various tools for the various types of services. **Co6:** Designing and working with various functionalities of operations centre and command centre **Co7:** Improve the operational efficiency of rims using various techniques.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA5CD21	**Advanced Web Technology**	**Co1**: Learn the html5 basics **Co2**: Identify different html5 features **Co3**: Usage of different multimedia aspects and api **Co4:** Ability to work on various canvas and storage options **Co5:** Usage of various geolocation apis and method
	16BCA5CD22	**Mobile Application Development**	**Co1:** Usage of mobile devices have increased exponentially over the past decade. Most of the people have more than one mobile devices. **Co2:** The introduction of smart phones have created a new revolution in the telecommunication industry. The rise in demand of mobile phones have led telecommunication companies to delve into newer technologies and standards. **Co3:** This course covers the basics of mobile network, device and their architecture. It explains the importance of developing quality applications - both native as well as web-based. **Co4:** The course explains about the importance, features, functions and types of mobile operating systems. **Co5:** Practical approach to the communication network protocol
	16BCA55S31	**Industry Oriented Software Engineering**	**Co1:** Learn basics of software processes **Co2:** Learn different types of requirements and system models. **Co3:** Explore different type of architectural designs **Co4:** Learn rapid software developmen
	16BCA5CS32	**Mobile Value Added Services**	**Co1:** Learn the basics of mobile value added services **Co2:** Understand the different types of value added services **Co3:** Explore different types of content based service **Co4:** Learn the basics of interactive web **Co5:** Create simple projects based on javascript object model
	16BCA56CS31	**Disaster Recovery And Business Continuity Management**	**Co1:** The students will be able to understand the importance of disaster recovery and give importance to the testing, maintenance and training process. **Co2:** They will be able to identify a wide variety of testing process that involves full interruption, walk through, and check listing, simulation and parallel

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA5CS32	**Management Of Data Centers**	**Co1:** Students will learn the history of datacentres, how they have evolved over the years, different facilities and their requirements. **Co2:** Students will also learn different aspects that have to be considered while designing a datacentre and various server. Farms and etc. **Co3:** Build a plan/model for disaster recovery**.**
VI	**16BCA6CD11**	**Windows Azure**	**Co1 :**Learn the basics of cloud technology in windows azure services like computer service, network service, data service and app service. **Co2 :** Learn the basics of cloud technology in azure storage basics. **Co3:** Learn the basics of cloud technology in azure networking. **Co4:** Learn the basics of cloud technology in azure active directory **Co5:** Learn the basics of cloud technology in azure websites.
	16BCA6ID12	**Cyber Forensic**	**Co1:** Computer forensics basics and case studies **Co2:** Storage devices and data acquisition methods **Co3:** Forensic techniques with respect to different operating systems **Co4:** Forensic techniques for analysing social networks and email investigation. **Co5:** Understanding various cyber laws and its sections,guidelines for forensic report writing.
	16BCA6CS31	**Mobile Ecosystem And Business Models**	**Co1:** Understand ecosystem and business model **Co2:** To develop student's understanding in mobile ecosystem **Co3:** To discuss various business models followed by the mobile industry **Co4:** To be able to learn mobile marketing model and apply them **Co5:** To be able to learn mobile gaming model for business and apply them.
	16BCA6CS32	**Mobile Testing**	**Co1:** Ability to explain software development life cycle, agile models and various types of testing. **Co2:** Able to distinguish different junit testsuite, test runners and their respective environment **Co3:** Ability to identify the android testing framework, types of testing in mobile application and also differentiate mobile web and testing native app. **Co4:** Ability to implement various test case using robotium testing tool. **Co5:** Ability to outline the features of espresso mobile application testing tool.

INTERNET OF THINGS (IOT)

2019-20 Batch

Semester	Course Code	Course Name	Course Outcomes (COs)
I	**20BCA1C03**	**Fundamentals Of Mathematics**	**CO 1 :** Apply the concept of Mathematical Logics. **CO 2:** Use concept of Matrices and Determinants. **CO 3:** Apply the concept of Mathematical Logics. **CO 4:** Solve the problems using concepts of Set theory. **CO 5:** Illustrate the implementation of Permutation and Combination
	20BCA1C04	**Computer Fundamentals & Organization**	**CO 1:** Identify the concepts and applications of computers. **CO 2:** Use of computer architecture and its languages efficiently. **CO 3:** Identify the importance of internal organization of computer and problem solving aspects. **CO 4**: Illustrate the networking of computers and IPR concepts. **CO 5**: Design the static webpage and use MS Office efficiently.
	20BCA1C05	**Programming In C**	**CO 1**: Analyse the algorithm and illustrate problem using flowchart. **CO 2:** Apply the concepts of an arrays in real time applications. **CO 3:** Use the functions for various problems. **CO 4:** Solve the problems using pointers and structures. **CO 5:** Illustrate the basic file operations.
	20BCA1C06	**Introduction To Linux**	**CO1**: Explore the basic LINUX commands with its architecture. **CO2:** Use LINUX file system and different system calls in files. **CO3:** Analyze the working of processes in LINUX operating system. **CO4:** Demonstrate the simple shell scripting with VI editor. **CO5:** Use the system administrative skills in Linux operating system.
II	**20BCA2C03**	**Operating Systems**	**CO 1:** Explore the fundamental components of a computer operating system. **CO 2:** Compare and recommend various scheduling algorithms for processes, and solve the deadlock problems. **CO 3:** Recommend the requirement of process synchronization and coordination handled by OS. **CO 4:** Analyze the memory management schemes. **CO 5:** Identify and compare the security and protection mechanisms related to an OS.

Semester	Course Code	Course Name	Course Outcomes (COs)
	20BCA2C04	**Object Oriented Programming With C++**	**CO 1:** Explore the features of concepts in object-oriented programming. **CO 2:** Apply the concepts like class, object and functions in basic programs. **CO 3:** Identify the use of operator overloading and apply inheritance concept for basic problems. **CO 4:** Illustrate the concepts of pointers and virtual functions. **CO 5:** Apply and relate the file operations concepts and its functionalities.
	20BCA2C05	**Data Structures Using C**	**CO 1**: Analyze algorithms and algorithm correctness. **CO 2**: Apply the searching and sorting techniques in real time applications. **CO 3**: Explore concepts on stack and queue operation and its implementation. **CO 4**: Adopt the knowledge of linked list on node of array. **CO 5**: Apply the concepts of trees and its applications.
III	**16BCA3C01**	**Fundamentals Of Information Security**	**CO1** : Explain basic principles, critical concepts of Informatin Security, System Development life cycle **CO2** : Summarize the concepts related to data protection and safe guarding of assets, various threats and attacks **CO3:** Classify and analyze the different risk mitigation strategy options, risk controls, process of risk assessment **CO4:** Illustrate and examine the need of Intrusion detection and prevention systmes - Firewall, Network security policies
	16BCA3C02	**Relational Database Management System (Rdbms)**	**CO 1:** Explain the basic concept of DBMS, its advantages and applications and to summarize the role of different database users **CO 2**:Illustrate ER - diagram notations for developing the logical design of the database, and to show the conversion of logical design to relational table **CO 3** :Evaluate the different SQL queries on database to create and manipulate relational database, and to illustrate relational algebra **CO 4** :Apply different normalisation techniques on the database by applying the concept of functional dependency/decomposition. **CO 5** :Analyse the concept of transaction processing, discuss different locking protocols and deadlock and recovery management, determine the view and conflict serializability of given schedule.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA3C03	**Computer Networks**	**CO 1** : Describe the functions of each layer in OSI and TCP/IP model. **CO 2** : Explain the network devices and Wireless networking components. **CO 3**: Classify the network routing protocols and analyze how to assign the IP addresses for the given network as well as describe the application layer. **CO 4:** Illustrate the WAN technology and to model the Network operating systems and trouble shooting network.
	16BCA3C04	**Programming In Java**	**CO 1:** Demonstrate Clear understanding of Object Oriented Programming paradigm **CO 2:** Demonstrate the Understanding of simplicity, type safe and modularity concepts of Java **CO 3:** Students will be able to develop a model web programming using Applet and developing the interface. **CO 4:** Apply Concept of multi-tasking through Thread/Multi-threading and learning the systems calls of JVM **CO 5:** Illustrate the Query processing through Java Programming and Understanding of Database and integration with JDBC
IV	**18BCA5C401**	**Introduction To Iot, Cloud & Bigdata**	**CO1:** Explain the basic concepts and terminology of Internet of things and Internet of Everything, IoT architecture, Principles and standards **CO2:** Examine and Describe the architecture view and the strategy of deploying IoT thing using cloud along with IoT Analytics concept **CO3:** Classify and Analyse terms of Cloud computing and its models along with services, types, issues and cloud plays an important role in IoT **CO4:** Describe the concepts of Virtualization and its types, the ways furnishing the tools and products of virtualization in real time environment **CO5:** Illustrate and Examine fundamentals of Big Data and it features along with Big Data Analytics and Algorithms to implement on real life scenarios

Semester	Course Code	Course Name	Course Outcomes (COs)
	18BCA5C402	**Basic Electronics And Sensor Technologies**	**CO1:** Describe the basic terminologies involved in design of electronic circuits and categorize the logic gates to help devise universal logic gates **CO2:** and identify the working Review the working of passive electrical components such as transistors and relays parameters involved **CO3:** Explain the functional elements of measurement systems and categorize sensors based on their application **CO4:** Label the numerous sensors categorized and identify the demonstrative capabilities of the sensors listed **CO5:** Scrutinize the selection criteria and real time applications of sensors and replicate the same through validated examples
	18BCA5D431	**Html5, Css, Javascript**	**CO1:** Gain knowledge about websites and technologies **CO2:** Implement the concepts of HTML and to create a web page with html **CO3:** Implement the concepts of css to blend with html **CO4:** Implement the basic concepts of js. **CO5:** Gain knowledge about XML and its attributes
	18BCA5D432	**Digital Communication**	**CO1:** Describe the random signal theory with its mathematical analysis base **CO2:** Explain the information theory in detail with different coding theorems **CO3**: Explain different coding techniques **CO4:** Explain the different digital modulation techniques **CO5:** Describe Baseband Transmission and Channel Coding schemes
	16MATH0G1	**Elements Of Discrete Mathematics**	**CO1:** Ability to apply properties of groups, subgroups, cyclic groups, group codes, decoding and hamming matrix to solve problems. And proof of Lagrange's theorem **CO2:** Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, mathematical induction, the pigeon-hole principle, and binomial expansion. **CO3:** Ability to apply Solving problems on closure, transitive, hasse diagrams, Warshall's algorithm and partial ordering to solve problems. **CO4:** Understand vector addition and scalar multiplication, algebraically. **CO5:** Apply the concept of group codes, decoding and hamming matrix to solve problems.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16MATH0G4	**Elements Of Probability&Statistics**	**CO1:** Ability to apply the statistics in different research areas. **CO2:** Ability to solve problem associate to the real life issues by using probability theory. **CO3:** Ability to solve problem associate to the real life issues by using probability addition and multiplication theorem. **CO4:** Implement the probability concept in data science. **CO5:** Implies the correlation and regression theory concept in data mining.
V	**17BCA5D11**	**Communication Protocols**	**CO1:** The communication protocols and their structure. **CO2:** The architectural view of communication protocols **CO3:** The communication protocols in IoT **CO4:** Applications and key area of communication protocols in real time networking. **CO5:** To understand real time IoT Communication protocols and its use cases.
	17BCA5D12	**Adhoc Mobile Wireless Network**	**CO1:** Identify the requirements for protocols for wireless ad-hoc networks as compared to the protocols existing for wired network. **CO2:** Explore current ad-hoc technologies by researching key areas such as algorithms, protocols, hardware, and applications. **CO3:** Provide advanced in –depth networking materials to graduate students in networking research. **CO4:** Provide hands-on experience through real-world programming projects. **CO5:** Practical approach to the communication network protocol.
	17BCA5D21	**Embedded C With Arduino**	**CO1:** Vision and Concept Developing Embedded Systems from Scratch **CO2:** History & Evolution of Microprocessor and Microcontrollers **CO3:** Understand Embedded Microcontrollers platforms and its Programming Techniques **CO4:** Understand Open Source Computing **CO5**: Understand and developing basic modules of Embedded Systems

Semester	Course Code	Course Name	Course Outcomes (COs)
	17BCA5D22	**Digital Signal Processing**	**CO1:** Specify the sampling, quantization, and signal conditioning requirements for a given DSP application. **CO2:** Determine and interpret the z-domain transfer function of a discrete-time system and design discrete time filters in the z domain using the pole-zero method. **CO3:** Design finite impulse response (FIR) and infinite impulse response (IIR) discrete-time filters for lowpass, high-pass, bandpass, bandstop, and arbitrary frequency response applications **CO4:** Implement digital filter designs in SCILAB. **CO5:** Analyze discrete-time filter banks and multi-rate signal processing systems.
	17BCA5S31	**Mobile Application Development**	**CO1:** Usage of mobile devices have increased exponentially over the past decade. Most of the people have more than one mobile devices. **CO2:** The introduction of Smart Phones have created a new revolution in the telecommunication industry. The rise in demand of mobile phones have led telecommunication companies to delve into newer technologies and standards. **CO3:** This course covers the basics of mobile network, device and their architecture. It explains the importance of developing quality applications - both native as well as web-based. **CO4:** The course explains about the importance, features, functions and types of mobile operating systems. **CO5:** Practical approach to the communication network protocol.
	17BCA5S32	**Nosql Database**	**CO1:** Understand about NoSQL databases **CO2:** Understand about basic principles and design criteria of NoSQL databases **CO3:** Compare among different types of NoSQL databases **CO4:** Understand different types of features of different NoSQL databases **CO5:** Implement internals of different NoSQL Databases.
	17BCA5S41	**Data Visualization**	**CO1:**Understand various ways to implement data visualisation **CO2:** Visualize data through seven stages of data analysis process. **CO3:** Study explanatory, exploratory and hybrid types of data visualization. **CO4:** Understand various stages of visualizing data.

Semester	Course Code	Course Name	Course Outcomes (COs)
	17BCA5S42	**Cloud Computing**	**CO1:** Understand Cloud and its Architecture **CO2:** Understand concept of Virtualization **CO3:** Implement Local Cloud and Internet connected cloud management **CO4:** Setting up Cloud platform step by step **CO5:** Understand IoT Cloud Architecture and Interface
VI	**17BCA6D11**	**Iot System Design**	**CO1 :** Practical approach to the communication network protocol **CO2 :** IoT System (Hardware) design using open source platform **CO3:** IoT System design using Industry standard hardware. **CO4:** Real time IoT Applications design using multiple platforms. **CO5:** Identify and apply the new trends in the field of technology pertaining to IoT.
	17BCA6D12	**Advance Embedded System**	**CO1:** Discuss and understand Architecture of Advanced Embedded System **CO2:** Interpret Architecture of ARM processor **CO3:** Illustrate the interfacing and programming with ARM Processors **CO4:** Examine rapid prototyping for embedded systems with Rasberry Pi **CO5:** Measure real time interfacing with Rasberry Pi & Arduino
	17BCA6S21	**Machine Learning**	**CO1:** Understand the difference between continuous class label and discrete class label classification methods. **CO2:** Predict the continuous class variable using linear regression analysis. **CO3:** Predict the binary class variable using decision tree and random forest. **CO4:** Understand the importance of Logistic regression and neural networks with its predication and application in business. **CO5:** Apply the assessment method to find the better fit model for classification techniques.
	17BCA6S22	**Big Data Analysis**	**CO1:** Summarize concept of BigData and its related terminologies. **CO2:** Outline need of Hadoop and its importance. **CO3:** Understand the use of HDFS for operations on storage unit. **CO4:** Analyze need and importance of MapReduce on big data. **CO5:** Test YARN for its efficiency on handling big data problems.

DATA ANALYTICS (DA)

2019-20 Batch

Semester	Course Code	Course Name	Course Outcomes (COs)
I	**20BCA1C03**	**Fundamentals Of Mathematics**	**CO 1 :** Apply the concept of Mathematical Logics. **CO 2:** Use concept of Matrices and Determinants. **CO 3:** Apply the concept of Mathematical Logics. **CO 4:** Solve the problems using concepts of Set theory. **CO 5:** Illustrate the implementation of Permutation and Combination
	20BCA1C04	**Computer Fundamentals & Organization**	**CO 1:** Identify the concepts and applications of computers. **CO 2:** Use of computer architecture and its languages efficiently. **CO 3:** Identify the importance of internal organization of computer and problem solving aspects. **CO 4**: Illustrate the networking of computers and IPR concepts. **CO 5**: Design the static webpage and use MS Office efficiently.
	20BCA1C05	**Programming In C**	**CO 1**: Analyse the algorithm and illustrate problem using flowchart. **CO 2:** Apply the concepts of an arrays in real time applications. **CO 3:** Use the functions for various problems. **CO 4:** Solve the problems using pointers and structures. **CO 5:** Illustrate the basic file operations.
	20BCA1C06	**Introduction To Linux**	**CO1**: Explore the basic LINUX commands with its architecture. **CO2:** Use LINUX file system and different system calls in files. **CO3:** Analyze the working of processes in LINUX operating system. **CO4:** Demonstrate the simple shell scripting with VI editor. **CO5:** Use the system administrative skills in Linux operating system.
II	**20BCA2C03**	**Operating Systems**	**CO 1:** Explore the fundamental components of a computer operating system. **CO 2:** Compare and recommend various scheduling algorithms for processes, and solve the deadlock problems. **CO 3:** Recommend the requirement of process synchronization and coordination handled by OS. **CO 4:** Analyze the memory management schemes. **CO 5:** Identify and compare the security and protection mechanisms related to an OS.

Semester	Course Code	Course Name	Course Outcomes (COs)
	20BCA2C04	**Object Oriented Programming With C++**	**CO 1:** Explore the features of concepts in object-oriented programming. **CO 2:** Apply the concepts like class, object and functions in basic programs. **CO 3:** Identify the use of operator overloading and apply inheritance concept for basic problems. **CO 4:** Illustrate the concepts of pointers and virtual functions. **CO 5:** Apply and relate the file operations concepts and its functionalities.
	20BCA2C05	**Data Structures Using C**	**CO 1**: Analyze algorithms and algorithm correctness. **CO 2**: Apply the searching and sorting techniques in real time applications. **CO 3**: Explore concepts on stack and queue operation and its implementation. **CO 4**: Adopt the knowledge of linked list on node of array. **CO 5**: Apply the concepts of trees and its applications.
III	**16BCA3C01**	**Fundamentals Of Information Security**	**CO1** : Explain basic principles, critical concepts of Informatin Security, System Development life cycle **CO2** : Summarize the concepts related to data protection and safe guarding of assets, various threats and attacks **CO3:** Classify and analyze the different risk mitigation strategy options, risk controls, process of risk assessment **CO4:** Illustrate and examine the need of Intrusion detection and prevention systmes - Firewall, Network security policies
	16BCA3C02	**Relational Database Management System (Rdbms)**	**CO 1:** Explain the basic concept of DBMS, its advantages and applications and to summarize the role of different database users **CO 2**:Illustrate ER - diagram notations for developing the logical design of the database, and to show the conversion of logical design to relational table **CO 3** :Evaluate the different SQL queries on database to create and manipulate relational database, and to illustrate relational algebra **CO 4** :Apply different normalisation techniques on the database by applying the concept of functional dependency/decomposition. **CO 5** :Analyse the concept of transaction processing, discuss different locking protocols and deadlock and recovery management, determine the view and conflict serializability of given schedule.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA3C03	**Computer Networks**	**CO 1** : Describe the functions of each layer in OSI and TCP/IP model. **CO 2** : Explain the network devices and Wireless networking components. **CO 3**: Classify the network routing protocols and analyze how to assign the IP addresses for the given network as well as describe the application layer. **CO 4:** Illustrate the WAN technology and to model the Network operating systems and trouble shooting network.
	16BCA3C04	**Programming In Java**	**CO 1:** Demonstrate Clear understanding of Object Oriented Programming paradigm **CO 2:** Demonstrate the Understanding of simplicity, type safe and modularity concepts of Java **CO 3:** Students will be able to develop a model web programming using Applet and developing the interface. **CO 4:** Apply Concept of multi-tasking through Thread/Multi-threading and learning the systems calls of JVM **CO 5:** Illustrate the Query processing through Java Programming and Understanding of Database and integration with JDBC
IV	**16BCA41C01**	**Probability And Statistics**	**CO1:** Ability to apply the statistics in different research areas. **CO2:** Solve problem associate to the real life issues by using probability theory. **CO3:** Solve problem associated to the real life issues by using probability addition and multiplication theorem. **CO4:** Implement the probability concept in data science. **CO5:** Imply the correlation and regression theory concept in data mining.
	16BCA4C02	**Web Technology**	**CO1:** Understand the concepts of client server communications and markup languages. **CO2:** Implement different style sheets and its properties along with client side programming. **CO3:** Illustrate the Document object model and server side scripting. **CO4:** Learn the server side JSP technology processing.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA41D31	**Big Data Programming**	**CO1:** Understand the basic concepts and terminology of Big Data and its Dimensions and concepts of HDFS commands **CO2:** Examine and Describe the functions of Mapreduce concepts, Code walkthrough, I/O types, MR program, Mapreduce Design and Patterns. **CO3:** Classify and Analyse the terms of Pig, Basic and Complex Data Analysis, Troubleshooting and optimising Pig. **CO4:** Describe the terminologies of Hive, Basic Data Analysis, Hive Data management, Text Processing and Transformations. **CO5:** Illustrate and Examine the Concepts of Data Analysis Using Pentaho as a ELT tool, Setting up Pentaho, Load Data among HDFS, Hive and RDBMS and Reporting concepts.
	16BCA41D32	**Data Visualization**	**CO1:** Ability to explain various Data Display Requires Planning, Iteration and Combination, Principles, Onward, Getting Started with Processing. **CO2:** Understand the A Simple Plot (Represent and Refine), Labeling the Current Data Set (Refine and Interact), Drawing Axis Labels (Refine), Choosing a Proper Representation (Represent and Refine), Using Rollovers to Highlight Points (Interact), Ways to Connect Points (Refine). **CO3:** Able to understand NTFS permissions for share and access the files. **CO4:** Ability to configure print server with various printer and able to work on remote management tools. **CO5:** Ability to create virtual machines and control VMs storage using Hyper-V manager.
V	**16BCA51D11**	**Non-Relational Databases**	**CO1 :** Understand different data structures of NoSQL **CO2 :** Study basics of Cassandra with Its architecture and data model. **CO3:** Implement different practical scenario's of practiced for CRUD, Querying, indexing, aggregation, etc **CO4:** Learn the knowledge of embedding java with Neo4j **CO5:** Learn the knowledge of HBase NoSQL software.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA51D12	**Advanced Rdbms**	**CO1**: Master the basic concepts and appreciate the applications of database systems. **CO2**: Familiarise with data warehousing and data mining techniques. **CO3**: Learn basic issues of transaction processing and concurrency control. **CO4**: Implement relational database theory, and be able to write relational algebra expressions for queries. **CO5**: Master working successfully on a team by design and development of a Database application system as part of a team.
	16BCA51D22	**Data Analytics**	**CO1:** Understand the architecture of data warehouse and database **CO2:** Understand the procedure involved in data analytics and analytical activities **CO3:**Implement the methods and steps implemented in order analyze data **CO4:** Learn ETL process in detail. **CO5:** Compare different computing tools for data analytics.
	16BCA51S31	**Python Programming**	**CO1:**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. **CO2:** Usage of modern tools to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. **CO3:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. **CO4:** Explore RDBMS and NRDBMS with python. **CO5:** Understand the graphics and Plotting. And Explore GUI tools available for python.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA51S41	**Data Modeling And Warehousing**	**CO1:** Understand the common designs and structures of warehouse systems and OLTP and OLAP operations in present industry applications. **CO2:** Get an understanding of Business Intelligence with various BI Tools and Critically evaluate the use of BI for supporting decision making in an organization. **CO3:** Explain the purpose of Requirements Analysis and to develop an entity-relationship model that represents the information requirements of the business. **CO4:** Transformation steps from conceptual model to SQL constructs. **CO5:** Understand UML notations with diagrams and to create a requirements model using UML class notations.
	16BCA51S42	**Cloud Technology**	**CO1:** Compare between normal storage and cloud storage with uses. **CO2:** Understand behavior of cloud technology with challenges to be faced. **CO3:** Understand the in and out of cloud components in detail. **CO4:** Usage of virtualization in a present industry. **CO5:** Implement different computing tools for cloud application development.
VI	**16BCA61D11**	**R Programming**	**CO1 :** Understand Looping's Using Vectors and List **CO2 :** Compare different Data Structures used in R **CO3:** Working with importing various files and plotting graph **CO4:** Implement various statistical distributions used in R **CO5:** Implement descriptive and predictive analytics.
	16BCA61D12	**Business Analytics**	**CO1:** Understand the various test that are used in descriptive analytics. **CO2:** Master the various algorithm and models of machine learning framework. **CO3:** Determine the various techniques and validation approaches of vector machines, neural networks and deep learning. **CO4:** Understand the challenges for big data analytics. **CO5:** Familiarise with the processes needed to develop, report, and analyze business data.

Semester	Course Code	Course Name	Course Outcomes (COs)
	16BCA61S21	**Quantitative Analysis Using Excel**	**CO1:** Implement different formatting features and formulae. **CO2:** Apply statistical functions on a data set and visualize the data. **CO3:** Identify various distribution functions on data set in different scenario. **CO4:** To explore web queries and connect to other databases. **CO5:** Learn importing data from business data and to work with external database.
	16BCA61S22	**Data Mining**	**CO1:** Determine the fundamentals of data mining and its principle. **CO2:** Compare and evaluate different data mining techniques like classification, prediction, clustering and association rule mining. **CO3:** Determine the different types of data mining in industry. **CO4:** Determine the impact and trends of data mining. **CO5:** Explore the tools and techniques of data mining visualization.