MASTER OF COMPUTER APPLICATIONS

Department of Computer Science and Engineering

Master of Computer Applications (MCA) emphasizes on the design and application of information systems and provides a solid background in business functions and Information Technology and covers latest developments in areas where commerce and computing and in general, applications and technology blend together successfully and define the state of art. MCA students acquire strength in principles, concepts and foundations of computer science, information technology and various applications. They would also have extensive programming / software development experience over a wide variety of platforms / applications. The curriculum has explicitly identified lab components for every course that discusses the principles with an implementation component.

The course is well balanced with significant emphasis on planning, designing and building complex commercial application software and system software. The application areas include transaction processing (such as banking, stock exchange order processing), simulation, database management, e-commerce, networking, embedded technologies, bioinformatics etc. This MCA programme is not only a complete professional grooming for students for a successful career in the IT industry, but also, provides value-based education through a system of wholesome learning.

This is a 3 year Post Graduate program specializing on Computer Applications. The students admitted to this program are with a graduation (B.Sc) in Mathematics, Physics, Statistics, Computer Science, BCA and B.Com. Also there is a provision for academically bright students with BCA, B.Sc (Information Technology) and B.Sc (Computer Science), to directly join the second year of the MCA programme through the lateral entry scheme.
## Curriculum

### First Semester

<table>
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<tr>
<th>Course Code</th>
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*Non – credit course

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### Second Semester

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### Third Semester

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**Total Credits**  109

### ELECTIVE I, II and III

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*There are 5 one-credit lab courses extending over 4 semesters. The department may choose the lab courses to be offered at their respective campuses.
SEMESTER I

16MA201 DISCRETE STRUCTURES 3-1-0-4


TEXT BOOKS/ REFERENCES:


16EN281 ENGLISH FOR PROFESSIONAL PURPOSES 0-0-1-1


TEXT BOOKS/ REFERENCES:


16CA201 COMPUTER ORGANIZATION AND ARCHITECTURE 3-0-1-4


TEXT BOOKS/ REFERENCES:

16CA203 COMPUTER PROGRAMMING 3-0-1-4


TEXT BOOKS/ REFERENCES:

16CA205 DATABASE MANAGEMENT SYSTEM 3-0-1-4


TEXT BOOKS/ REFERENCES:

16CA207 PROBLEM SOLVING TECHNIQUES 3-0-1-4


TEXT BOOKS/ REFERENCES:

SEMESTER II

16MA202 STATISTICS AND NUMERICAL METHODS 3-1-0-4


TEXT BOOKS/ REFERENCES:

16CA202 OBJECT ORIENTED PROGRAMMING 3-0-1-4


TEXT BOOKS/ REFERENCES:

16CA204 DATA STRUCTURES 3-0-1-4
Note: Basic operations and applications of all data structures shall be covered, Different implementations with efficiency analysis shall be discussed.

Abstract Data Types, Linear Data Structures: Arrays (single and multi-dimensional), Stack ADT, Multi Stack ADT, Queue ADT, Circular Queue, Singly Linked List, Doubly Linked List, Circular Linked List.


Graphs: Matrix and List Representation of Graphs, Breadth First Search, Applications of BFS, Depth First Search, Applications of DFS, Spanning Trees

Advanced Data Structures: Dictionaries, Hashing techniques, Disjoint Sets, List, Tree and Array based implementation – Union/Find.

TEXT BOOKS/REFERENCES:

16CA206 OPERATING SYSTEMS 3-0-1-4


TEXT BOOKS/REFERENCES:

16HU282 FINANCIAL ACCOUNTING 2-0-0-2


TEXT BOOKS/ REFERENCES:

SEMESTER III

16CA301 ADVANCED COMPUTER NETWORKING AND INTERNET 3-0-1-4

Overview - The Network Edge- The Network Core– Delay– Loss and Throughput in Packet Switched Networks - Application layer protocols – HTTP- DNS – PPP file sharing

TEXT BOOKS/ REFERENCES:

16CA303   DESIGN AND ANALYSIS OF ALGORITHMS  3-1-0-4

Analysis of iterative programs, Analysis of recursive programs: Recurrence Relation:
Substitution method, Recursion Tree Methods, Master Method.
Sorting: Bubble – Insertion Sort- Selection Sort. Divide and Conquer: Quick Sort- Merge
Sort- Bucket Sort-Lower Bounds- Heap Sort – Comparisons of Sorting.
Greedy Algorithm: Fractional Knap-sack Problem- Task Scheduling Problem.
Dynamic Programming: Matrix Multiplication Problem- 0/1 Knap-sack Problem.
String Matching: FSA- KMP- Boyer- Moore Algorithm.
Graph Algorithms: Graph Traversals (DFS, BFS with Analysis) - Shortest Path Algorithms
(with Analysis) – Dijkstra - Bellman Ford- Floyd Warshall’s all Pair shortest path Algorithm-
Minimum spanning Tree (with Analysis) – Kruskal– Prims.
NP Problems: Definition: P-NP-NP Complete-NP Hard. Examples:P-NP.

TEXT BOOKS/ REFERENCES:


16CA305   ADVANCED SOFTWARE ENGINEERING  3-0-1-4

Software Engineering – Introduction - Software Classification - Layered Technology –
Software Process –Practice - Generic Process Model , Process Assessment and Improvement
– CMMI framework - Perspective Models - Specialized Models - Agile Process Models
Requirements Engineering – SRS - Requirement Analysis- Unified Modeling Language –
Approaches- Scenario based Modelling - UML Models that supplement Use Cases –
Activity and Swim lane Diagrams - Design Engineering - Architectural Design - Modeling
Component level design - Performing User Interface Design.
Software Testing - Strategic Approach to Software Testing - , Test Strategies for
conventional and Object Oriented Software - Validation Testing - System Testing – Art of
Debugging - Testing Techniques - White Box Testing – Basis Path Testing,- Control
Structure Testing - Black Box Testing .
Overview.

TEXT BOOKS/ REFERENCES:


16CA307 BASICS OF OPERATIONS RESEARCH 3-1-0-4


TEXT BOOKS/ REFERENCES:


SEMESTER IV

16CA304 SERVICE ORIENTED ARCHITECTURE 3-0-1-4

SOA - WSDL, SOAP – UDDI - UDDI – Message Exchange Patterns – Coordination – Orchestration – Choreography -WS- Transaction
Tools Available for Appropriate Designing - Implementing SOA. SOA Platform Basics: SOA Support in J2EE, JAXWS, JAXB, JAXR, JAX-RPC, WSIT, SOA support in .NET, ASP.NET web services

TEXT BOOKS/ REFERENCES:

16CA306 DATA MINING AND APPLICATIONS 3-0-1-4

Mining Frequent Patterns: Basic Concept – Frequent Item Set Mining Methods - Mining Association Rules – Association to Correlation Analysis.
Mining Data Streams- Mining Time-Series Data- Mining Sequence Patterns in Biological Data- Graph Mining – Social network Analysis
Mining Object, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Text Mining – Latent Semantic Analysis, Linear Discriminant Analysis, Fischer Discriminant, Mining the World Wide Web, Applications and Trends in Data Mining
Evaluation metrics – Precision, Recall, F-measure

TEXT BOOKS/ REFERENCES:
1. Jiawei Han, Micheline Kamber and Jian Pei, “Data mining concepts and Techniques”, Third Edition, Elsevier Publisher, 2006.

16CA308 ADVANCED DATABASES 3-1-0-4

Introduction to Object Oriented Database: Abstraction, encapsulation, and information hiding, Classes, Inheritance Overloading Polymorphism and dynamic binding - Object-Oriented Data Model.
Complex Data Types – Structured Types and Inheritance in SQL – Table Inheritance – Array and Multiset Types in SQL – Object-Identity and Reference Types in SQL – Implementing OR Features – Persistent Programming Languages – Object – Relational Mapping.
Concurrency Control: Optimistic concurrency control–Deadlock management – detection, avoidance, and resolution – Distributed deadlock – Structured (top actions, distributed nested) transactions.Distributed Query Processing
Spatial and Temporal Data and Mobility: Time in Databases – Spatial and Geographic Data – Multimedia Databases – Mobility and Personal Databases.
Concepts of NoSQL Databases

TEXT BOOKS/ REFERENCES:

16EN600 TECHNICAL WRITING P/F

Different kinds of written documents: Definitions - descriptions - instructions - recommendations - manuals - reports – proposals, Instructions manual, job applications with Resume Introduction to Writing dissertations, papers, and technical proposals
Technical paper writing: Library research skills - documentation style - document editing – proof reading - formatting
Practice in oral communication: Group Discussion, Interviews, and Technical presentations

TEXT BOOKS/ REFERENCES:

SEMESTER V

16CA401 SOFTWARE ARCHITECTURE 3-1-0-4

Definition of Software Architecture- Importance of Software Architecture - The Many Contexts of Software Architecture
Understanding Quality Attributes – Availability- Interoperability - Modifiability - Performance – Security - Testability - Usability
Architectural Patterns: Layered - MVC - Broker – Pipes and Filters – Kernel - 6. Peer-to-Peer - Publish-Subscribe-Shared Data - Design patterns
Architecture in Agile Projects - Architecture in the Cloud - Service Oriented Architecture – case studies

TEXT BOOKS/ REFERENCES:
4. Alan Shalloway and J R Trott, Design Patterns Explained, Pearson, 2004
Overview of Information Security: Confidentiality – Integrity – Access Control – Availability - Malicious Software (Viruses, Trojans, Rootkits, Worms, Botnets)


Database Security: Security Requirements -Reliability and Integrity-Sensitive Data – Inference -Multilevel Security


TEXT BOOKS/ REFERENCES:

16CA498 DISSERTATION 0-0-0-5

The objective of Dissertation – Phase 1 is to gear up students for preparation of Dissertation-Phase 2 in Semester-VI. Dissertation provides an opportunity to the students to demonstrate independence and originality in thought and application. Students will select topics from the field of computer application and based on a thorough review of literature on that topic, they will identify the problems and decide on plans of research for dissertation. Under the supervision of faculty members, they will execute their plans involving theoretical and/or experimental work. Students will have to prepare proper documentation consisting of SRS, Modeling Techniques, Development Strategies and Implementation and Testing Strategies. Student may use any Design Methodologies such as SSAD, OOAD and UML etc. This is done during phase 1. Regular reviews will be conducted.

SEMESTER 6

16CA499 DISSERTATION 0-0-0-12

The results obtained in phase 1 will be analysed to arrive at a conclusion which will lead to some novelty in the field of computer application. Dissertation will be prepared as per the prescribed format/ guidelines and will be presented in the form of regular reviews. The Dissertation work will be evaluated continuously over the span of the semester as per the approved procedure. For the final review, the department may appoint external expert from industry or academics. Also, a technical paper based on the work done has to be submitted.
and published at a reputed conference which indexes the publications in SCOPUS. The formalities insisted by the department in this regard has to be strictly adhered to.

**ELECTIVES**

**16CA314 INFORMATION SECURITY 3-0-0-3**


**TEXT BOOKS/ REFERENCES:**


**16CA316 STRUCTURE AND INTERPRETATION OF COMPUTER PROGRAMS 3-0-0-3**


**TEXT BOOKS/ REFERENCES:**


16CA318 SOFTWARE QUALITY ASSURANCE 3-0-0-3


TEXT BOOKS/ REFERENCES:


16CA322 COMPUTATIONAL INTELLIGENCE 3-0-0-3


TEXT BOOKS/ REFERENCES:
Introduction to Bioinformatics: Definition - Importance and Uses of Bioinformatics - Information Technology - Systems Biology. 
Applications of Data Mining to Bioinformatics Problems - Biological Data – Databases - Protein Sequencing - Nucleic Acid Sequencing - Sequence to Structure Relationship. 

TEXT BOOKS/ REFERENCES:


TEXT BOOKS/ REFERENCES:


16CA334 INTELLIGENT SYSTEMS 3-0-0-3

Introduction to Agents: Structure of Intelligent Agents – Problem Solving Agents– Formulating Problems
Decision Network- Value of Information- Learning Agents – Learning from Observations – Knowledge in Learning - Case Studies on Applications of AI.

TEXT BOOKS/ REFERENCES:


16CA336 OPEN SOURCE SYSTEMS 3-0-0-3


TEXT BOOKS/ REFERENCES:


Introduction to Distributed Systems – Primitives for Distributed Communication – Design Challenges – Distributed Systems like Models for Distributed Computations –


Distributed Query Processing: Overview of Query Processing – Transforming Global Queries to Fragment Queries - Query Decomposition - Localization of Distributed data. Distributed Transaction Processing and Concurrency Control – 2PC -3PC.
TEXT BOOKS/ REFERENCES:


16CA417 WIRELESS COMMUNICATIONS AND NETWORKS 3-0-0-3


TEXTBOOK / REFERENCES:

16CA419 COMPUTER GRAPHICS AND VISUALIZATION 3-0-0-3

Projections. OpenGL Two-Dimensional and Three-Dimensional Viewing Functions-OpenGL Animation.

TEXT BOOKS / REFERENCES:


16CA421 COMPUTER LANGUAGE ENGINEERING 3-0-0-3

Semantic Analysis: Symbol Table, Type Checking using Abstract Syntax Tree, Type Checking using Attributed Grammars .
Activation Records: Structure of Frames. Intermediate Representation: Conversion to IR Trees
Canonicalization of IR Trees and Three Address Code – Basic Block and Traces.

TEXTBOOKS / REFERENCES:


16CA423 SEMANTIC WEB TECHNOLOGIES 3-0-0-3

Introduction to Semantic Web: Semantic Web Concepts- Need for the Semantic Web-
Features - RDF Schema – Non-Contextual Modelling. Web Ontology Language: Motivation and Overview –
Knowledge Representation: Languages - Formalisms, Logics - Description Logics - Ontology Design and Management using the Protege Editor - Ontology Reasoning with Pellet/FACT++, Ontology Querying with SPARQL.

TEXT BOOKS / REFERENCES:


16CA425 CLOUD COMPUTING 3-0-0-3

Cloud Computing Architecture- Service Models – Deployment Models- Infrastructure as a Service
Resource Virtualization-Server-Storage-Network-Platform as a Service- Cloud Platform and Management- Software as a Service- Case Study on Eucalyptus. Service Management in Cloud Computing

TEXT BOOKS / REFERENCES:


16CA429 DATABASE ADMINISTRATION 3-0-0-3

Introduction: DBMS Architecture and Data Independence - DBA Roles and Responsibilities.
SQL * PLUS Overview: SQL plus Fundamentals, Producing more readable outputs, Accepting Values at Runtime, Using iSQL *Plus.
Backup and Recovery Overview: Defining a Backup and Recovery Strategy, Testing- The Backup and Recovery Plan. Introduction to Performance Tuning: Brief Overview of Tuning methodology, General Tuning Concepts

TEXT BOOKS/REFERENCES:


16CA431 DIGITAL IMAGE PROCESSING 3-0-0-3

Comparative Study of Filters in Frequency Domain and Spatial Domain.
Edge Detection - Line Detection - Curve Detection - Edge Linking and Boundary Extraction - Thresholding Algorithms- Region Based Segmentation - Region Growing - Connected
Components Labeling - Region Growing and Region Adjacency Graph (RAG), Split and Merge Algorithms - Morphology - Dilation, Erosion, Opening and Closing.

TEXTBOOKS/ REFERENCES:

16CA433 BUSINESS INTELLIGENCE 3-0-0-3

Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, 3-tier data warehouse architecture, Data Marts
Introduction to Multi-Dimensional Data Modeling-Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling,
OLAP operations, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, OLAP Servers – MOLAP, ROLAP, OLAP query model and query processing, indexing OLAP Data, Data Warehouse Implementation
Introduction to business metrics and KPIs, creating cubes using SSAS. Basics of Enterprise Reporting- Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, introduction to SSRS Architecture, enterprise reporting using SSRS.

TEXT BOOKS/ REFERENCES:
2. Jiawei Han, Micheline Kamber and Jian Pei, “Data mining concepts and Techniques”, Third Edition, Elsevier Publisher, 2006.

16CA435 NETWORK MANAGEMENT AND SYSTEM ADMINISTRATION 3-0-0-3


TEXT BOOKS / REFERENCES:


16CA437 BIG DATA ANALYTICS AND VISUALIZATION 3-0-0-3

Introduction of big data – Big data characteristics - Volume, Veracity, Velocity, and Variety – Data Appliance Challenges and Issues, Case for Big data, Big data sources, Features of data, - Evolution of Big data – Best Practices for Big data Analytics - and Integration tools


Introduction to Predictive Analytics: Simple Linear regression, Multiple Linear regression, Logistic Linear Regression. History of Visualization, Goals of Visualization, Types of Data Visualization: Scientific Visualization, Information Visualization, Visual Analytics, Impact of visualization

Introduction to Data Processing , Map Reduce Framework , Hadoop ,HDFS , S3 Hadoop Distributed file systems, Apache Mahout, Hive,Sharding, Hbase , Impala , Case studies : Analyzing big data with twitter ,Big data for Ecommerce , Big data for blogs.

TEXUTH BOOKS/ REFERENCES:

5. Multiple Regression and Beyond 1st Edition by Timothy Z. Keith (Author)

16CA439 MODERN WEB APPLICATION DEVELOPMENT USING MEAN STACK

1. Basics of HTML, CSS, and Javascript
   HTML, CSS, Bootstrap, Javascript basics – Variables, functions, and scopes, Logic flow and loops, Events and Document object model, Handling JSON data, Understanding Json callbacks.
2. Introduction to Node JS
   Installation, Callbacks, Installing dependencies with npm, Concurrency and event loop fundamentals, Node JS callbacks, Building HTTP server, Importing and exporting modules, Building chat application using web socket.
3. Building REST services using Node JS
   REST services, Installing Express JS, Express Node project structure, Building REST services with Express framework, Routes, filters, template engines - Jade, ej.s.
4. MongoDB Basics and Communication with Node JS
   Installation, CRUD operations, Sorting, Projection, Aggregation framework, MongoDB indexes, Connecting to MongoDB with Node JS, Introduction to Mongoose, Connecting to MongoDB using mongoose, Defining mongoose schemas, CRUD operations using mongoose.
5. Building Single Page Applications with AngularJS
   Single Page Application – Introduction, Two-way data binding (Dependency Injection), MVC in Angular JS, Controllers, Getting user input, Loops, Client side routing – Accessing URL data, Various ways to provide data in Angular JS – Services and Factories, Working with filters, Directives and Cookies, The digest loop and use of $apply.

16HU441 PRINCIPLES OF ECONOMICS AND MANAGEMENT


TEXTBOOKS/REFERENCES:


16HU443 SOFTWARE PROJECT MANAGEMENT 3-0-0-3


TEXTBOOK / REFERENCES:


LAB COURSES

16CA451 DATA STRUCTURES AND ALGORITHMS LAB 0-0-3-1

Posteriori analysis of iterative and recursive algorithms, plotting of growth rate. Implementation of singly linked list, doubly linked list, circular linked list. Stack and Queue implementation using array and SLL, comparison of efficiencies, Applications of Stack and Queue – Infix to postfix, postfix expression evaluation, Implementation of Polynomial ADT using SLL.

Binary search tree implementation. Heap implementation using array, Heap sort, Implementation of sorting algorithms – Bubble sort, Insertion Sort, Selection Sort, Quick
Sort- Merge Sort, performance comparison of sorting algorithms for various classes of inputs like nearly sorted, unsorted etc.

O(V^2) and O(E log V) implementations of Dijkstra algorithm, BFS and DFS implementation, graph cycle detection using BFS. Topological sort using DFS, Prims and Kruskals MST. Dynamic Programming based solution for 0-1 Knapsack problem, Recursive matrix chain multiplication.

16CA452       JAVA PROGRAMMING       0-0-3-1


TEXT BOOKS/ REFERENCES:

16CA453       GUI PROGRAMMING USING VB.NET       0-0-3-1

Introduction to .NET, .NET Framework features & architecture, CLR, Common Type System, MSIL, Assemblies and class libraries. Introduction to visual studio, Project basics, types of project in .Net, IDE of VB.NET- Menu bar, Toolbar, Solution Explorer, Toolbox, Properties Window, Form Designer, Output Window, Object Browser. The environment: Editor tab, format tab, general tab, docking tab. visual development & event drive Programming -Methods and events.
The VB.NET Language- Variables -Declaring variables, Data Type of variables, Forcing variables declarations, Scope & lifetime of a variable, Constants, Arrays, types of array, control array, Collections, Subroutines, Functions, Passing variable Number of Argument Optional Argument, Returning value from function.
Database programming with ADO.NET – Overview of ADO, from ADO to ADO.NET, Accessing Data using Server Explorer. Creating Connection, Command, Data Adapter and Data Set with OLEDB and SQLDB. Display Data on data bound controls, display data on data grid.
TEXT BOOKS/ REFERENCES:
1. Vb.net programming black book by Steven Holzner –Dreamtech publications
2. Mastering vb.net by EvangelosPetroutsos- bpb publications Introduction to .net framework-Worx publication

16CA454 ANDROID APPLICATION DEVELOPMENT  0-0-3-1

Menu, Dialog, List and Adapters
What is Menu?-Custom Vs. System Menus-Creating and Using Handset menu Button (Hardware)-What are Android Themes. What is Dialog? How to create an Alter Dialog?
List & Adapters
Database SQLite
IntroducingSQLite-SQLiteOpenHelper and creating a database-Opening and closing a database
Working with cursors Inserts, updates and deletes
Location Based Services and Google Maps
Using Location Based Services -Working with Google Maps
Multimedia Programming using Android
Multimedia audio formats-Creating and Playing -Multimedia audio formats-Kill / Releasing (Memory Management)-How to associate audio in any application-How to associate video playback with an event
WebView
How to develop your own custom made Web browser -How to use WebView object in XML Permission for using the Internet-Methods for associated with ‘Go’, ‘Back’, ‘Forward’ etc

TEXT BOOKS/ REFERENCES:
1. Head first Android Development

16CA455 WEB DEVELOPMENT USING ASP.NET  0-0-3-1

Understanding role of Web Server and Web Browser - Form Tag and comparison between Get and Post methods - Understanding HTML Form Tag and elements within it –
ASP.NET Introduction - First ASP.NET Application - Auto Postback Property - Event Handler Parameters - Comparison between HtmlControls and WebControls - ASP.NET Architecture
Life Cycle of ASP.NET Page - Master Pages - Validation Controls - ASP.NET State Management - Cookies-HttpCookie - Sessions-HttpSessionState
Application-HttpApplicationState -WebConfiguration File and Global.asax - Data Bound Controls - Publishing Web Application
Creating web application in IIS - Using Virtual Directory - Publishing ASP.NET Website.

16CA456 DATABASE MANAGEMENT SYSTEMS LAB  0-0-3-1

Table Design- Data Definition Language (DDL) commands - Table creation and alter(include integrity constraints such as primary key, referential integrity constraints, check, unique and null constraints both column and table level, Drop - Other database objects such as view, index, cluster, sequence, synonym etc. - Practice SQL Data Manipulation Language (DML) commands - Row insertion, deletion and updating - Retrieval of data - Simple select query - Select with where options (include all relational and logical operators) - Functions: Numeric,
Data, Character, Conversion and Group functions with having clause. - Set operators - Sorting data - Sub query (returning single row, multiple rows, more than one column, correlated sub query) - Joining tables( single join, self-join, outer join) - Data manipulations using date functions - User defined functions in a query- Transaction Control Language (TCL) commands (Grant, revoke, commit and save point options) - Usage of triggers, functions and procedures using PL/SQL constructs

16CA457 OPERATING SYSTEMS LAB 0-0-3-1


16CA458 COMPUTER ORGANIZATION AND ARCHITECTURE LAB 0-0-3-1

Basic Organization and Hardware Components of a Personal computer- Assembling of Personal Computer-: Formatting- Partitioning the Hard Disk- Installation of Windows and Linux Operating System- Digital Circuits: Realisation of Logic Gates- Realization of logic functions with the help of universal gates-NAND Gate- Half /Full Adder & Half/Full Subtractor - Code Conversion

16CA459 WEB AND XML PROGRAMMING USING JAVA AND J2EE 0-0-3-1

Introduction to Frameworks – Hibernate – Spring