Semester-V

MAJOR COURSE - 7

Course Name: Microprocessor and Computer Architecture

Course Code: BCAMJ501

Course Type: **Major (Theoretical+Practical)**	Course Details: **MJC-7**			L-T-P: **3-0-4**	
Credit: 5	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Microprocessorthe Brain of the computer. Functional units of Microprocessor. General & Special purpose register:AC,PC,SP,DR,DAR,MAR, Flags,B-C,D-E,H-L pairs,PSW.

UNIT II. 8-bit microprocessor architecture; 8085 pin description.

UNIT III. Programmers model of 8085, addressing modes of 8085; Instruction set of 8085; Assembly language program for 8085.

UNIT IV. Introduction to 8086 microprocessor: 16-bit registers, segmented memory architecture.

UNIT V. Memory and I/O Systems: Peripheral Devices, I/O Interface, Data Transfer Schemes, Program Control, Interrupt, DMA Transfer, I/O Processor. Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories, Cache Memory, Associative Memory,Interleave, Virtual Memory, Cache Mapping Techniques, Memory Management.

UNIT VI. Parallel Processing: Parallel Processing Basics: Using multiple functional units or processors to perform tasks simultaneously to increase computational speed. Flynn's Classification: Computer architectures categorized into SISD (Single Instruction, Single Data), SIMD (Single Instruction, Multiple Data), MISD (Multiple Instruction, Single Data), and MIMD (Multiple Instruction, Multiple Data). Types of Parallel Computers: Array processors, systolic arrays, and associative processors.

UNIT VII. Vector Processing: Vector Processing Basics: Performing operations on multiple data elements simultaneously using vector instructions. Vector Instructions: Include arithmetic operations (addition, subtraction, multiplication, division), logical operations, and load/store operations. Vector Registers: Packing multiple data elements into a single register for efficient processing.

UNIT VIII. Pipelining and Parallel Processing: Pipelining: Breaking down operations into sequential sub-operations that can overlap in execution. Pipeline Speedup: Increasing throughput by performing operations concurrently across multiple pipeline stages.

Practical

UNIT I: Microprocessor: Programming should be developed using 8085 assembly language.

1. Addition of Two 8-bit Numbers
2. Subtraction of Two 8-bit Numbers
3. Addition of Two 16-bit Numbers
4. Find the Largest/Smallest Number in an Array
5. Count Number of Zeros in an Array
6. Sum of Array Elements
7. Data Transfer from One Block to Another
8. Exchange Contents of Two Memory Locations
9. Check Whether a Number is Even or Odd
10. Reverse an Array

UNIT II. Computer Architecture

1. Create a fetch routine of the instruction cycle.
2. Create a machine based on the given architecture (Register Sets, Memory, Instruction format and basic computer instructions).
3. Matrix Multiplication in Computer Architecture
4. Analyze the performance impact of pipelining: Considering how pipelining affects instruction throughput.
5. Identify and handle data hazards: Managing dependencies between instructions in a pipeline.

Internal (CA) Evaluation: Practical Note Book (15 marks), One experiment (10 marks) from UNIT II, Viva-voce (5 marks).

ESE Evaluation: One experiment (10 marks) from UNIT I, Viva-voce (10 marks)

References/ Suggested Readings:

1. Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, PENRAM.
2. Barry B. Brey, The Intel Microprocessors:Architecture, Programming and Interfacing. Pearson Education.
3. Walter A Triebel, Avtar Singh, The 8088 and 8086 Microprocessors Programming, Interfacing, Software,Hardware, and Applications. PHI.
4. Computer System Architecture, M. Morris Mano, 3rd Edition, Prentice Hall.
5. Computer Architecture: A Quantitative Approach, John L. Hennessy, David A. Patterson, 4th Edition.

MAJOR COURSE - 8

Course Name: Computer Networks

Course Code: BCAMJ502

<table>
<tr><td>Course Type: Major (Theoretical+Practical)</td><td colspan="2">Course Details: MJC-8</td><td colspan="2">L-T-P: 3-0-4</td></tr>
<tr><td rowspan="3">Credit: 5</td><td rowspan="3">Full Marks: 100</td><td colspan="2">CA Marks</td><td colspan="2">ESE Marks</td></tr>
<tr><td>Practical</td><td>Theoretical</td><td>Practical</td><td>Theoretical</td></tr>
<tr><td>30</td><td>15</td><td>20</td><td>35</td></tr>
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Course Content:

Theory

UNIT I. Introduction to Computer Networks and Networking Elements: Network Definition, Network Topologies, Network Classifications, Network Protocol, Layered Network Architecture, Overview of OSI Reference Model, Overview of TCP/IP Protocol Suite, Hub, Switch (Managed and Unmanaged), Routers.

UNIT II. Data Communication Fundamentals and Techniques: Analog and Digital Signal, Data-Rate Limits, Digital to Digital Line Encoding Schemes, Pulse Code Modulation, Parallel and Serial Transmission, Digital to Analog Modulation - Multiplexing Techniques-FDM, TDM, Transmission Media, Transmission mode.

UNIT III. Networks Switching Techniques and Access Mechanisms: Circuit Switching, Packet Switching- Connectionless Datagram Switching, ConnectionOriented Virtual Circuit Switching; Dial-Up Modems, Digital Subscriber Line, Cable TV for Data Transfer.

UNIT IV. Data Link Layer Functions and Protocol: Error Detection and Error Correction Techniques, Data-Link Control- Framing and Flow Control, Error Recovery Protocols-Stop and Wait ARQ, Go-Back-N ARQ, Point to Point Protocol on Internet.

UNIT V. Multiple Access Protocol and Network Layer: CSMA/CD Protocols, Ethernet LANS; Connecting LAN and Back-Bone Networks- Repeaters, Hubs, Switches, Bridges, Router and Gateways, Networks Layer Functions and Protocols, Routing, Routing Algorithms, Network Layer Protocol of Internet - IP Protocol, Internet Control Protocols.

UNIT VI. Transport Layer and Application Layer Functions and Protocols: Transport Services- Error and Flow Control, Connection Establishment and Release- Three Way Handshake, Overview of Application Layer Protocol, Overview of DNS Protocol; Overview of WWW & HTTP Protocol.

Practical

UNIT I. Network Devices and Configuration

1. Identification of network devices like hub, switch, modem etc.
2. Use of ping, tracert/traceroute, ipconfig/ifconfig, route, and arp utilities.
3. Configure LAN
4. Configure IP static routing.
5. Configure IP routing using RIP.

UNIT II. All programs should be developed in C/ C++ / Java / Python

1. Simulate Cyclic Redundancy Check (CRC) error detection algorithm for noisy channel.
2. Simulate Hamming-code based error detection & correction algorithm for noisy channel.
3. Simulate and implement stop and wait protocol for noisy channel.
4. Simulate and implement go back N sliding window protocol.
5. Simulate and implement selective repeat sliding window protocol.
6. Simulate and implement MST construction (Prim's, Kruskal's) for Ethernet
7. Simulate and implement the various routing algorithms (RIP, Distance-Vector routing, Dijkstra's, Bellman-Ford, Floyd-Warshall, Flooding)
8. Socket Programming.

Internal (CA) Evaluation: Practical Note Book (15 marks), One experiments from Unit I (10 marks), Viva-voce (5 marks)

ESE Evaluation: One experiment from Unit II (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. B. A. Forouzan: Data Communications and Networking, Fourth edition, THM Publishing Company Ltd.
2. A. S. Tanenbaum: Computer Networks, Fifth edition, PHI Pvt. Ltd 2011
3. William Stallings:Data and Computer Communications, Eight Edition, Pearson.
4. Larry L. Peterson, Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann Publishers In.

MAJOR COURSE - 9

Course Name: Core Java

Course Code: BCAMJ503

Course Type: **Major (Theoretical+Practical)**	Course Details: **MJC-9**			L-T-P: **3-0-4**	
Credit: 5	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		30	**15**	**20**	**35**

Course Content:

Theory

UNIT I. Introduction to Java:Java Architecture and Features, Compiling and Executing a Java Program, Variables, Constants, Keywords, Data Types, Operators (Arithmetic, Logical and Bitwise) and Expressions, Type Conversion and Type Casting, Decision Making Constructs (Conditional Statements and Loops) and Nesting, Java Methods (Definition, Scope, Passing and Returning Arguments, Built-in Java Class Methods).

UNIT II. Arrays, Strings and I/O:Creating and Using Arrays (One-Dimensional and Multi-Dimensional), Referencing Arrays Dynamically, The Java *String* Class, Creating and Using String Objects, Manipulating Strings, String Immutability and Equality, Passing Strings to and from Methods, *StringBuffer* Class, Simple I/O using *System.out* and *Scanner*Class, Byte and Character Streams, Reading and Writing from Console and Files.

UNIT III. Object-Oriented Programming Overview:Principles of Object-Oriented Programming, Defining and Using Classes, Controlling Access to Class Members, Class Constructors, Method Overloading, Class Variables and Methods, Objects as Parameters, Final Classes, *Object* Class, Garbage Collection.

UNIT IV. Inheritance, Interfaces, Packages, Enumerations, Autoboxing and Annotations (Metadata):Inheritance (Single Level and Multilevel, Method Overriding, Dynamic Method Dispatch, Abstract Classes), Interfaces and Packages, Extending Interfaces and Packages, Package and Class Visibility, Using Standard Java Packages *(util, lang, io)*, Wrapper Classes, Enumerations, Autoboxing and Unboxing, Annotations.

UNIT V. Java Collection Classes: Collection interfaces: Collection, List, Set, Map. Implementation classes: ArrayList, LinkedList, HashSet, TreeSet, HashMap, TreeMap.- Operations: Adding, removing, iterating over elements.

UNIT VI. Exception Handling, Threading:Exception Types, Uncaught Exceptions, Built-in Exceptions, Creating Your Own Exceptions, The *Thread* Class and Runnable Interface, Creating Single and Multiple Threads, Thread Prioritization, Synchronization and Communication, Suspending and Resuming Threads.

Practical

Students are required to implement object-oriented paradigm using JAVA. Below is the list of some of the experiments.

1. Program on strings: Check the equality of two strings, Reverse a string.

2. Program using loops: to find the sum of digits of a given number, display a multiplication table, display all prime numbers between 1 to 1000.

3. Program to demonstrate all math class functions.

4. Program on files: to copy a file to another file using stream classes of java IO package.

5. Program to demonstrate method over-riding and overloading

6. Programs on inheritances.

7. Multi-threaded programming.

8. Implement a method to find the most frequent element in a List.

9. Remove duplicates from a List while preserving order.

10. Exception handling

Internal (CA) Evaluation: Practical Note Book (15 marks), Two experiments (10 marks), Viva-voce (5 marks)

ESE Evaluation: Two experiments (10 marks), Viva-voce (10 marks)

References/ Suggested Readings:

1. E. Balagurusamy, Programming with Java, Tata McGraw Hill.
2. John R. Hubbard,Programming with JAVA, Schaum's Series.
3. Herbert Schildt, The Complete Reference Java 2, Tata McGraw Hill.
4. David A. Watt, Deryck Brown, Java Collections: An Introduction to Abstract Data Types, Data Structures and Algorithms, John Wiley & Sons, Inc.

MINOR COURSE - 5

Course Name: Introduction to Geometry and Probability-Statistics

Course Code: BCAMN501

Course Type: **Minor (Theoretical)**	Course Details: **MNC-5**			L-T-P: **4-1-0**	
Credit: 5	Full Marks: **100**	CA Marks		ESE Marks	
		Practical	Theoretical	Practical	Theoretical
		-	**30**	**-**	**70**

Course Content:

Theory

Unit I. Analytical two-dimensional Geometry:

Slope of lines and angle between two lines. Various form of equations of line: Parallel to Axes, Point-Slope form, Slope intercept form, two-point form, intercept form.
Translation and rotation of rectangular axes, invariants, general equation of seconddegree in two variables---reduction to standard forms and classification.Plane polar equations of straight line, circle, ellipse, parabola and hyperbola.

Unit II: Three-Dimensional Geometry:

Co-ordinates in space, Direction cosines, Angle between two lines, Projection of Join of two points on a Plane,Equations of Plane, straight line in space, Conditions for a line to lie on a plane, Conditions for two lines to be coplanar, Shortest Distance between two lines.

Unit III. Probability:

Random experiment, sample space, mutually exclusive events, equallylikely events.Definition of probability--Classical and axiomatic approaches.Addition rule for two events, Independence of events, conditional probability, multiplication rule.Bayes' theorem and its applications, Boole inequality.Joint experiment, independent trial, Bernoulli's trial, Binomial law.

Unit IV. Random variables and Probability distributions:

Random variable, Distribution function (discrete and continuous) with their properties, probability mass function and probability density function. Mean and variance of a random variable.Discrete probability distributions—Binomial and Poisson distributions, Continuous distributions—Uniform, Normal and Cauchy distribution.

Unit V. Analysis of Univariate data:

Constructionof frequency distribution, Graphical presentation of data---histograms, frequency polygon and cumulative frequency curves.Measure of central tendency—Arithmetic mean, Geometric mean, median and mode and their properties.Measures of dispersion—Range, quartile deviation, mean deviation, and standard deviation.

Unit VI. Sampling and Statistical inference

Sampling distribution of binomial, poisson and normal population**.** Estimation of parameters for binomial, poisson and normal populations**.** Method of finding confidence intervals for Normal population.

References/ Suggested Readings:

1. S. Narayan and P. K. Mittal, *Analytical Solid Geometry*, S. Chand & Company Pvt Ltd.,India.
2. P K Jain and K. Ahmed, *Textbook of Analytical Geometry of Two Dimensions*, New Age International Publishers.
3. P K Jain and K. Ahmed, *Textbook of Analytical Geometry of Three Dimensions*, New Age International Publishers
4. A.N.Das, *Analytical Geometry of Two and Three Dimensions*, New Central Book Agency.
5. R.M. Khan, *Analytical Geometry of Two and Three Dimensions and Vector Analysis*, New Central Book Agency.
6. N G. Das, *Statistical Methods* (Vol. I & II)— Mc Graw Hill.
7. A. Goon, M. Gupta, B. DasGupta, *Fundamentals of Statistics*– (Vol. I & II)—World Press.
8. P C. Biswal, *Probability and Statistics*, PHI Learning
9. D. Bhattacharya and S. Roychowdhury, *Probability and Statistical Inference (Theory and Practice)*, U.N. Dhur & Sons Pvt. Ltd.
10. D. Biswas, *Probability and Statistics*, New Central Book Agency.
11. A. Mukherjee, *Fundamental treatise on Probability and Statistics*, Sreetara Prakashan.
12. Md. I. Haque, *An Introduction to Probability and Statistics*, Techno World.