ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)

1st Semester

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)
1st Semester

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	MCA202101	Computer Organization and Architecture	3	0	0	3	30	70
2	MCA202102	Design and Analysis of Algorithms	3	1	0	4	30	70
3	MCA202103	Programming Techniques using Python and Java	3	1	0	4	30	70
4	MCA202104	Advanced Database Systems	3	0	0	3	30	70
5	MCA202105	Operating Systems	3	1	0	4	30	70
Practical								
1	MCA202116	Laboratory- Java and Assembly Language Programming	0	0	8	4	30	70
Bridge Courses [For Non-Computer Students]								
Theory								
1	MCA202B106	Introductory Programming and Data Structures using C	3	1	0	0	-	100
2	MCA202B107	Mathematical Foundation of Computer Science	3	1	0	0	-	100
3	MCA202B108	Fundamentals of Computer Systems and Networking	3	1	0	0	-	100
Practical								
1	MCA202B116	Laboratory- C and Data Structures	0	0	8	0	-	100
TOTAL			**15/24**	**3/6**	**8/16**	**22**	**180**	**420/820**
Total Contact Hours per week: 26/46								
Total Credits: 22								

Detail Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202101	**Computer Organization and Architecture**	**3-0-0**	**3**

MODULE 1: CPU Architecture (15 Lectures)

Instruction format - operand addressing formats – three, two one and zero address instructions; Instruction set selection, Instruction types: data transfer, data manipulation and program control; Addressing modes - direct, indirect, immediate, relative, indexed etc. Instruction execution process - fetch and execution cycles; data path organization – single and two bus; control structure: hardwired and micro-programmed; control steps in different instruction execution, Reduced instruction set computer (RISC), CISC and RISC characteristics, block diagram and pin diagram of 8085, use of registers in assembly language programs, assembly language programming.

MODULE 2: Computer Arithmetic (7 Lectures)

Review of addition and subtraction with signed magnitude and 2's complement data, hardware implementation, Multiplication algorithm, Hardware implementation, hardware algorithm, Booths multiplication algorithm, Array multiplier, Division basic, Floating point arithmetic.

MODULE 3: I/O Architecture (15 Lectures)

Characteristics of simple I/O devices, their controllers; I/O interface – addressing: memory mapped and isolated I/O, data transfer: Synchronous and Asynchronous data transfer, types of asynchronous data transfer: strobe control, handshaking. Modes of data transfer: program controlled, interrupt initiated and DMA data transfer; polled and interrupt controlled synchronization; Interrupt mechanism - device identification - polling, vectored; priority schemes - daisy chaining, interrupt masking; Concept of DMA - cycle stealing and burst mode, DMA interface bus arbitration mechanism; Concept of I/O channels and peripheral processors.

MODULE 4: Advanced Memory Concepts (8 Lectures)

Memory hierarchies, Cache memory- Mapping techniques, Virtual memory- address space, memory space, address mapping using pages.

Textbooks:

1. Mano M.M: Computer system Architecture, PHI (EEE)
2. Hamacher, Vranesic and Zaky: Computer Organization, TMGH

References Books:

1. William Stallings, Computer Organization and architecture, Pearson
2. Hennessey: Computer Architecture, Elsevier
3. Stallings: Computer Organization & Architecture, PE
4. Hayes : Computer Architecture & Organization, MGH

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202102	Design and Analysis of Algorithms	3-1-0	4

MODULE 1: Introduction (8 Lectures)

Algorithms, Analysis of Algorithms, Design of Algorithms and complexity of Algorithms, Asymptotic Notations, Growth of Function, Recurrences Sorting in Polynomial Time: Insertion Sort, Merge Sort

MODULE 2: Design and Analysis Techniques (10 Lectures)

Divide and Conquer, merge sort, finding closest pair of points. Augmented Data Structure- Red-Black tree, OS-Tree, Interval Tree, B-Tree, AVL tree

MODULE 3: Greedy Algorithms (10 Lectures)

Coin charging, Kruskal's, Prim and Dijkstra's algorithm, Knapsack problem.

Dynamic Programming:

Coin charging problem, matrix multiplication, longest common subsequence, Floyd and War shall algorithm. Application of Sorting and Searching

MODULE 4: Graph Algorithms (6 Lectures)

Topological sort, minimum spanning trees, shortest paths, maximum-flow – Flow networks, Ford-Fulkerson method, Maximum bipartite matching.

MODULE 5: Concept of different Problem classes and Introduction to Approximation Algorithms (6 Lectures)

P, NP, NP-Complete, Easy vs Hard, Polynomial time, non-deterministic algorithms, reducibility.

Approximation Algorithms:

Traveling salesman problem, Parallel and Distributed algorithms.

Text Books/ References Books:

1. Introduction to Algorithm by Thomas Corman , CE Leiserson Roland L Rivest, C Stein
2. Fundamentals of Algorithms - Ellis Horowitz, S Salini S. Rajasekaran

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202103	Programming Techniques using Python and Java	3-1-0	4

PART 1

MODULE 1: Introduction to Java (7 Lectures)

Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

Objects and Classes : Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, this reference.

MODULE 2: Inheritance and Polymorphism (8 Lectures)

Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

MODULE 3: Event and GUI programming (10 Lectures)

Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

PART II

MODULE 4: Introduction to Python Programming Language (2 Lectures)

Built in Functions, Conversions, Numeric Data Types, String Operators, String Slices, String Operations, String Values, Naming Conventions, IDLE, Dynamic Types, Strengths and Weaknesses, Introduction to Python Language.

MODULE 5: (3 Lectures)

The while Loop, break and continue, Bit Wise Operators, True or False, Operators, Logical, Relational Operators, the if Statement, Indenting, Control Flow and Syntax, Introduction, Data Collections and Language Component: Copying Collections. Sorting Dictionaries, Dictionaries, Sets, Tuples, the for Loop, Lists

MODULE 6: (7 Lectures)

Classes in Python, Object and Classes: Principles of Object Orientation, File Organization, Instance Methods, Creating Classes, 12 25 Custom Exception Classes, Type Identification, Polymorphism, Inheritance, Class Variables, Special Methods

MODULE 7: (8 Lectures)

The dir Function, Standard Modules – time, Standard Modules – math, Standard Modules – sys, Modules, Lambda, Mapping Functions in a Dictionary, Passing Functions to a Function, Functions - "First Class Citizens", Scope, Variable Number of Arguments, Passing Collections to a Function Keyword and Optional Parameters, Function Documentation, Parameters, Defining Your Own Functions, Introduction, Functions and Modules

Text Books/ References Books:

1. Dive into Python, Mike
2. Learning Python, 4th Edition by Mark Lutz
3. Programming Python, 4th Edition by Mark Lutz

4. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
5. Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.
6. Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
7. Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.
8. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH. 6 Java Programming, D. S. Malik, Cengage Learning

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202104	**Advanced Database Systems**	**3-0-0**	**3**

MODULE 1: Introduction to Relational Database Design (3 Lectures)
What is DBMS, advantage of using DBMS, data models (object based logical models, record based logical models), DBMS users, overall system structure Hierarchical and network data models and related data structures

MODULE 2: Entity Relationship Models and Relational Database Design (10 Lectures)
ER diagrams, generalization, specialization, aggregation. Database models - Network model, Hierarchical model, and Relational model.
Relational database design: Underlying concepts, structure, study of relational languages (relational algebra, SQL, QBE). Integrity constraints (domain constraints, referential, assertions, triggers, functional dependencies), Normalization (using FDs, multivalued dependencies, join dependencies), Domain -key normal form

MODULE 3: Transactions (6 Lectures)
Concept, state, ACID properties, serializability and recoverability, testing for serializability. **Concurrency Control:** Lock - based, protocols, timestamp based protocols, validation based protocols, multi version schemes, deadlock handling

MODULE 4: Recovery System (3 Lectures)
Log based recovery (deferred and immediate database modification), checkpoints, shadow paging, recovery with concurrent with transactions, buffer managements in recovery, recovery from loss of non - volatile storage, logical undo logging, transaction rollback, restart recovery, fuzzy checkpointing

MODULE 5: Query Processing (4 Lectures)
Storage and file structure, file organization: disk storage systems, blocking factor, Access path: searching, indexing and hashing techniques, external sorting, transformation of relational expressions, breaking of queries into sub queries to optimize execution plan, Select, Project and Join Operations, set operations, aggregation Cost based query optimization. measurement of cost of a query considering different access path, evaluation of expressions.
Heuristic query optimizations: query tree query graph and representation of queries in query tree, Steps for heuristic query optimization, semantic query optimization.

MODULE 6: Parallel Databases (4 Lectures)
Parallel database architecture, scale up and speedup using parallel database architecture, Introductory concepts, partitioning techniques, interoperation parallelism and intra operation parallelism - Parallel Sort algorithms (range partitioning sort, parallel external sort-merge), Parallel Join Algorithms (partitioned join, fragment-and-replicate join, parallel hash join), interoperation parallelism (pipelined, independent). Example of parallel databases

MODULE 7: Distributed Databases (6 Lectures)
Replication and fragmentation, network transparency, join processing, distributed transaction processing, two-phase and three-phase commit protocols, handling failure, coordinator selection, concurrency control (locking, timestamping), deadlock handling (centralized, fully distributed), multi-database systems.

MODULE 8: Security and Integrity (4 Lectures)

Violations, authorization, views, privileges, granting privileges, discretionary and mandatory access control mechanism, Bell La-podulas Security Access Control Mechanism, designing databases using mandatory access control mechanisms, security specification in SQL.

Text Books/ References Books:

1. Elmasari and Navathe, Fundamentals Of Database System, Narosa Publishing Company, 1989.
2. J.D. Ullman, principles of Database Systems, Galgotia Publishing Private Limited.
3. Silberschats, Kroth and Sudershan, Principles of Database Systems, McGraw Hill Publication.
4. 4. C.J. Date, An Introduction to Database Systems, Vol-I and Vol-II, Addison-Wesley Publishing Company.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202105	Operating Systems	3-1-0	4

MODULE 1: Introduction and Historical Perspective (3 Lectures)

Operating System concept and it's role, Batch processing, multiprogramming, time-sharing, distributed system, Functions, components and structure of an operating system

MODULE 2: Process Management (18 Lectures)

Structure of a process, PCB, operations on processes, Support for concurrent processes-Trade-off sequential and concurrent processing with examples in implementation Shared data, Critical sections, Mutual exclusion, busy form of waiting, lock and unlock primitives, semaphore, block and wakeup, Producer-consumer problem, multiple producer and consumer and synchronization, Dinning Philosopher's problem, monitors, Starvation problem in scheduling and Priority inversion.

Inter process communication mechanisms and primitives. Communication mechanisms in Client-Server system.

Threads:

Multithreading Models, Threading issues, kernel and user thread implementations Pthreads, thread affinity.

Scheduling:

Process states, context switching, schedulers, scheduling criteria, types of scheduling algorithms, Implementation of concurrency Primitives.

System deadlock: Causes of deadlock and deadlock handling strategies: prevention, detection and avoidance

MODULE 3: I/O Systems (3 Lectures)

I/O Management device controller, Device drivers, I/O Software goals and structure, Interrupt and handling mechanisms, Application of I/O Interface, Terminal handling, Block and character devices. Vectored I/O

MODULE 4: Memory Management (7 Lectures)

Address space management: address binding, logical vs physical address space, Static and dynamic memory management protection and sharing, Contiguous and non - contiguous memory allocation, fragmentation and solution; Swapping, Paging and Segmentation, page table; page replacement and space allocation policies. Combined paging and segmentation, Virtual memory, Demand Paging and performance assessment; Page replacement policies, Thrashing, Working set model, Kernel Memory Allocation.

MODULE 5: File System and Disk Management (6 Lectures)

File concept and organization, File management strategies, File system structure and access methods, tradeoffs, Directory structures, Allocation Methods: contiguous, linked, indexed, FAT and I-node structures, File system protection, Security, Integrity, Device independence. Protection domain and protection matrix. File Recovery, backup and restore.

Mass storage device structure, Disk management and disk scheduling algorithms.

MODULE 6: Case study of Operating Systems (4 Lectures)

Concepts of Distributed and Network Operating System. Fundamental concepts on Embedded/Real time operating systems. Eg Rt LINUX

Text Books:

1. Silbersehatz A., Galvin P.B. and Gagne G: "Operating System Concepts", Wiley, 9th Ed.
2. Milenkovic M., "Operating System - Concepts and Design", McGraw Hill.
3. Tanenbaum A.S.: "Operating System - Design and Implementation", PHI **(**EEE).
4. Bach, M.: "Design of the UNIX operating system", PHI(EEE).

Reference Books:

1. Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
2. Dietel, R.N., "An Introduction to Operating Systems", Addison Wesley
3. Walia Ekta, "Operating System Concepts", Khanna Book Publishing and Co.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202116	Laboratory- Java and Assembly Language Programming	0-0-8	4

SL. No.	PART-1: STATEMENT OF THE PROBLEM (40%)
1	Write a Java Program to define a class, describe its constructor, overload the Constructors and instantiate its object
2	Write a Java Program to define a class, define instance methods and overload them and use them for dynamic method invocation
3	Write a Java Program to demonstrate use of sub class
4	Write a Java Program to demonstrate use of nested class
5	Write a Java Program to implement inheritance and demonstrate use of method overriding
6	Write a Java Program to implement multilevel inheritance by applying various access controls to its data members and methods
7	Write a program to demonstrate use of implementing interfaces
8	Write a program to demonstrate use of extending interfaces
9	Write a Java program to implement the concept of importing classes from user defined package and creating packages
10	Write a program to implement the concept of threading by extending Thread Class
11	Write a program to implement the concept of threading by implementing Runnable Interface
12	Write a program to implement the concept of Exception Handling using predefined exception
13	Write a program to implement the concept of Exception Handling by creating user defined exceptions
14	Write a program using Applet to display a message in the Applet
15	Write a Java Program to demonstrate Keyboard event
16	Write a Java Program to demonstrate Mouse events
17	Write programs for using Graphics class • to display basic shapes and fill them • draw different items using basic shapes • set background and foreground colors
18	Write a Menu Driven Program in Java which performs sorting of a group of integer values using bubble sort method
19	Write a class called “Student” with a) Instance variable roll_no, name, semester and branch b) A method called “setdata ()” which takes 4 parameters and returns void. This method must contain statements to set the values of instance variables of each object of” Student” class c) A method called “calculate ()” which does not have any input parameter and returns a double value. This method must contain statements to take input for marks of 5 subjects (Physics, Chemistry, Mathematics, English and Hindi) and calculate the percentage of marks using formula: Percentage marks= (Total marks/500) *100 The method must also contain a return statement to return the calculated percentage value d) A method called “showdata ()” which does not take any parameter and returns void. This method must contain statement to display the values of roll no, name, semester, branch and percentage of mark of each object of “Student” class Write another class “StudentRecord” which contains the main () method. Inside the main() method write statements to create 3 different object of “Student” class and display the values of their instance variable with the calculated percentage of marks for each of them using Menu
20	Write a class called “Employee” with a) Instance variables Employee code, Employee name and Basic salary

	b) A parameterized constructor which contains statements to set the values of instance variables of each object of "Employee" class c) A method called "calculate ()" which does not have input parameter and it returns a double value. This method contains statements to calculate the gross salary of an Employee object using the formula HRA= 60% of Basic salary DA= 98% Basic salary Gross Salary= Basic Salary + HRA + DA This method must contain a return statement to return the calculated value of Gross salary d) A method called "showdata ()" which does not take any parameter and return void. This method must contain statements to display the values of instance variables and calculated gross salary of each object of "Employee" class Write another class "EmployeeRecord" which contains the main () method. Inside the main() method write statements to create 3 different object of "Employee" class and display the values of their instance variable with the calculated gross salary for each of them using Menu
PART-2: PYTHON PROGRAMMING (30%)	
1	Write a Program in Python to convert Celsius to Fahrenheit
2	Write a Program in Python to Check Leap Year
3	Write a Program in Python to Find the Factorial of a Number
4	Write a Program in Python to Print the Fibonacci sequence
5	Write a Program in Python to Convert Decimal number to a) Binary b) Octal c) Hexadecimal
6	Write a Program in Python to Sort Words in Alphabetic Order
7	Write a Program in Python to print the largest and smallest element in an array
8	Write a Program in Python to Count Even and Odd Numbers in a List
9	Write a Program in Python to check if a given key exists in a Dictionary
10	Write a Program in Python Program to Merge Two Dictionaries Example
11	Write a Program in Python Program to Print Floyd's Triangle using For Loop
12	Write a Program in Python to Check Whether a String is Palindrome or Not
13	Write a Program to Create a Class and Object in Python
14	Write a Program in Python to demonstrate single level inheritance in Python
15	Write a Program in Python to demonstrate multiple inheritance in Python
16	Write a Program in Python to demonstrate Operator Overloading in Python
17	Write a Program in Python to calculate the factorial of a number using recursion
18	Write a Program in Python to Multiply all numbers in the list (4 different ways)
19	Write a Program in Python to Join Tuples if similar initial element
20	Write a Program in Python to perform Insertion sort
PART-3: ASSEMBLY LANGUAGE PROGRAMMIMG (30%)	
1	Write a program to find the sum of two BCD numbers stored in memory
2	Write a program, which will read two decimal numbers, then multiply them together, and finally print out the result (in decimal)
3	Write a program to convert the ASCII code to its BCD equivalent
4	Write a program, which will read in two decimal inputs and print out their sum, in decimal
5	Write a program, which will read in two decimal inputs and print out the smaller of the two, in decimal

6	Write a program to calculate the average of three given numbers stored in memory
7	Write a program in 8086 assembly language to find the volume of sphere using following formula: V = 4/3π r3
8	Write a program to evaluates 3 * (x^3) + 4x + 5 if flag = = 1 or evaluates 7x + 8 if flag== 0. Assume x is a 16-bit unsigned integer
9	Write a program to convert Centigrade (Celsius) to Fahrenheit temperature measuring scales. Using formula: Celsius = (Fahrenheit - 32) * 5 / 9
10	Write a Program which adds the sales tax in the Price list of items and replace the Price list with a new list
11	Write a program to find the factorial of decimal number given by user
12	Write a program to find n Cr for a given n and r
13	Write a program to arrange given N numbers in descending order
14	Write a program, which will read in decimal inputs repeatedly until a zero value is read; at this point, it should print out the sum of the numbers read in so far
15	Develop and execute an assembly language program to find the LCM of two 16-bit unsigned integers
16	Develop and execute an assembly language program to find the HCF of two unsigned 16-bit numbers
17	Write a program for finding the largest number in an array of 10 elements
18	Develop and execute a program to sort a given set of 8-bit unsigned integers into ascending order
19	Develop and execute an assembly language program to sort a given set of 16- bit unsigned integers into descending order
20	Write a Program which adds the sales tax in the Price list of items and replace the Price list with calculated values

Bridge Courses [For Non-Computer Students]

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202B106	**Introductory Programming and Data Structures using C**	**3-1-0**	**0**

MODULE 1: Introduction to Computers (6 Lectures)
Introducing and Interacting with Computers, Computer, organization, Number System & Computer codes, Computer Arithmetic, Boolean Algebra and IO Devices

MODULE 2: Introduction to Memory and Languages (6 Lectures)
Processor and Memory, Types of Storage Devices, Computer Software and types, Basics of Programming, Programming Languages. Language Elements, Algorithms and Flowcharts

MODULE 3: Problem Solving with C Programming (10 Lectures)
History, Execution of C Program, Constants, Variables and Keywords, Data types, Expressions, constants, variables, Operators, Operator Precedence and associativity, data input and output, Formatted Console I/O Functions, Conversion Specifications, assignment statements, conditional statements, Looping Statements, Storage Classes

MODULE 4: Array and Modular Programming (6 Lectures)
Introduction to Function, Functions with Simple Output Parameters, Passing Values between Functions, Multiple Calls to a Function, Parameter Passing by Value v/s Parameter Passing by Reference, Recursion **Arrays**: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Multidimensional Arrays, Passing arrays as arguments

MODULE 5: Structures, Unions, Strings and Pointers (6 Lectures)
Structures & Unions- definition, Processing structures – Passing structures to a function. Pointers: Operations on Pointers – Pointers to Functions, Functions Returning Pointers, Arrays of pointers. String handling

MODULE 6: Sorting and Searching (6 Lectures)
Different sorting techniques: Bubble sort, quick sort, insertion sort
Different sorting techniques: Linear search, Binary Search, hashing

MODULE 7: Linear Data Structure (6 Lectures)
Stack, Queue, Linked List various operations and application**, Nonlinear Data Structure:** Binary Tree, Binary Search Tree, AVL Tree, B Tree, Graph, Depth First Search, Breadth First Search

Text Books:

1. Peter Norton," Introduction to Computers", 6th Edition,2009.
2. Yashvant Kanetkar,"Let Us C", BPB Publications, 13th edition, 2012.
3. S Prasad, K.R Venugopal, "Mastering C", Tata McGraw Hill, 2006.
4. E.Balaguruswamy, "Programming in ANSI C", Tata McGraw Hill, 6th edition, 2012

Reference Books:

1. Pradeep K Sinha, PritiSinha, "Computer Fundamentals", 6th Edition, 2003.
2. Bayron Gottfried, "Schaum's Outline of Programming with C", 4th Edition, 2018 (Paper Back).
3. Kernighan and Ritchie, "The C Programming Language", Prentice Hall, 2015 (Paper Back).

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202B107	Mathematical Foundation of Computer Science	3-1-0	0

MODULE 1: Sets, Functions and Relations (7 Lectures)

Set: Set, subset, power set, properties of set, operations on sets, products on set, representation of set in computer partitions.

Functions and relation: Binary relation, types of relation, equivalence relation and equivalence class, closure of relation, function, different types of functions.

MODULE 2: Matrices and Operations (5 Lectures)

Matrices and types, Matrix arithmetic, Matrix transpose, Determinants, Difference between matrix and determinant, Determinant of a matrix, Matrix Inversion

MODULE 3: Mathematical Logic and Mathematical Induction (4 Lectures)

Truth tables, algebra of propositions, conditional proposition, logical arguments, principle of mathematical induction

MODULE 4: Introductory Concept on Formal logic (7 Lectures)

Revision of propositional and first orders predicate logic, Normal forms: conjunctive normal form, clausal form. Premises, arguments and hypothesis, testing validity, logic of proof and inference rules, predicate calculus, Logic programming: Introduction to Prolog

MODULE 5: (6 Lectures)

Combinatorics: Fundamental principle, Factorial notation, permutation and combination

Principle of counting: Principle of inclusion and exclusion, pigeonhole principle

Group Theory: Binary operation and laws, Algebraic structure, Group and properties, Order of an element in group

Recurrence Relations and Generating Function: recurrence relation, solving recurrence relation by substitution and generating functions, Characteristics roots solution of homogeneous recurrence relation

MODULE 6: Probability and Statistical Concepts (14 Lectures)

Probability Theory: Sample spaces; Events and probability; Discrete probability; Union, intersection and compliment of events; conditional probability; Bayes Theorem, Random Variables and Distribution: Random variables, Discrete Probability Distribution - Binomial, Poisson, Density functions and Distributions functions; Continuous probability distribution - Normal, Student's t & x
(chi - square) statistic, Large sample tests for mean and proportion, Moments and Moment generating functions: Linear correlation coefficient: Multiple correlation.

Mathematical Expectations: Expectations, variance and co - variance, Addition and Multiplication theorem of Expectation

Text Books:

1. Trembly,Manohar, "Discrete Mathematical Structures"
2. J.E.Hopcroft & J.D. Ullman, "Introduction to Automata Theory, Languages & Computations", Narosa Publishing House 1999
3. Dr. S.K Sarkar, "A Text Book of Discrete Mathematics", S Chand and Company.
4. Mishra, K.L.P, Chandrasekaran, N., "Theory of Computer Science", PHI.

References:

1. S Santha, "Discrete Mathematics with Combinatorics and Graph Theory", Cengage Learning
2. Liu, C.L and Mahapatra, D.P, "Elements of Discrete Mathematics", Tata McGraw Hill.
3. C.K Nagpal, "Formal Language and Automata Theory", Oxford University Press.
4. Anuradha, A Puntambekar: Theory of Computation, Technical Publication.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202B108	Fundamentals of Computer Systems and Networking	3-1-0	0

MODULE 1: Representation of Information (7 Lectures)

Number System: Binary, octal, hexadecimal. Positive and negative numbers; fixed point and floating point numbers. **Arithmetic Operations:** Addition, subtraction, etc. Character codes: ASCII and EBCDIC. Redundant coding for error detection and correction: Concept Hamming distance, parity codes, and Hamming code, block codes, cyclic redundancy code

MODULE 2: Digital Logic and Gates (15 Lectures)

Logic Design: Boolean algebra, Boolean variables and functions - canonical and standard forms, truth table, minimization of Boolean functions - Karnaugh map.

Logic Gates: AND, OR, NOT, NAND, NOR, XOR, EXOR/Equivalence

Combinational and Sequential Circuits:

Combinational Circuits: Block Diagram, Implementation of Boolean functions using logic gates; Adder – Half Adder, Full Adder, Subtractor - Half Subtractor and Full Subtractor, decoders, encoders, Multiplexers, Combinational Logic Circuit Design, simple arithmetic and logic circuits.

Sequential Circuits: Block Diagram, flip flop: RS, D, JK, T, Master Slave, Sequential Circuit Design, Shift Registers and Counters – synchronous and asynchronous

MODULE 3: Introduction to Computer Networks (8 Lectures)

Overview: Goals of networking, types, application, topologies, Standards, performance issues. Basics of digital communication, signal, noise, LAN, MAN, WAN. Networking and internetworking devices.

Network Architecture: ISO-OSI reference model, TCP/IP model, design philosophy, layer, protocol, interface, and service concepts. Layer-wise functionality

MODULE 4: Physical Layer (10 Lectures)

Basic functions and services, Concepts of data transmission, Analog and digital Transmission, Asynchronous and Synchronous transmission, bandwidth, data rate of a Channel, modulation and multiplexing methods: PCM, FDM, TDM, switching techniques (Circuit, Packet switching and message switching), modem, encoding methods, communication media.

Introduction to data link and network layers.

Text Books/References:

1. Digital Logic and Computer Design – PHI (EEE) Mano, M.M.
2. Computer Organisation and Architecture – William Stallings.
3. Tanenbaum A.S., Computer Network, PHI (EEE)
4. Forouzan, Data communication and networking, 4th Edn, TMGH

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202B116	Laboratory- C and Data Structures	0-0-8	0

Exp. No.	STATEMENT OF THE EXPERIMENT
1	Write a program to compute the GCD of three numbers.
2	Write a program to compute the LCM of three numbers.
3	Write a program to write a program which read a decimal number and convert that number to either • Binary. • Octal • Hexadecimal
4	Write a program to find the largest and smallest element in an array
5	Write a menu driven program to create an array of integers and perform the following operations • Insert an element in a specific position of the array • Delete an element from a specific position of the array • Search an element in the array • Reverse the array elements. • Sort the elements in the array • Remove Duplicate Elements from the array • Frequency of each element
6	An array A contains 5 elements whereas another array B contains 10 elements. write a function to create an array C that contain only those elements that are common to both A and B
7	Write a program to merge two sorted array, merged array is also in sorted order
8	Write a program that accepts a string and count the number of vowel , consonant , blank , digits , special characters
9	Write a menu driven program to create a two dimensional array of integers (matrix)and perform the following operations • Addition of two matrices • Multiplication of two matrices • Transpose of the matrix
10	Write a menu driven program to create a two dimensional array of integers (matrix)and perform the following operations • Row Sum • Column Sum • Sum of Diagonal Elements (for two possibilities) • Sum of Upper Triangular Element • Sum of Lower Triangular Elements
11	Write a program to find the sum of digits of a given numbers using recursion
12	Write a program to generate first n Fibonacci terms using recursion
13	Write a program using pointer to check a string is palindrome or not
14	Write a program that takes the following information of n students and print the name and roll numbers according to their performance Roll No ii) Name iii) Marks of 3 subjects hints: struct student { introllno; char name[20]; int mark[3]; }std[10];
15	Write a program that accept two times in hh:mm:ss format and added up
16	Write a program to that take roll no, name, marks of N students as input and display the information of a particular student whose name is specified by the user

17	Write a program to display the largest elements among three elements entered by the user using macro
18	Write a program that accept a string in upper case and convert the string to lower case using command line arguments
19	Enter some data in a file, place the character and integers in two different file
20	Write a program in to create a singly linked list of integers and perform the following operations • Add a node at the end of a linked list • Add a node at the beginning of a linked list • Add a node after a specified position • Count the number of nodes present in the linked list • Delete a specified node from the linked list • Reverse the linked list
21	Write a program in to create a doubly linked list of integers and perform the following operations • Add a node at the end of a linked list • Add a node at the beginning of a linked list • Add a node after a specified position • Count the number of nodes present in the linked list • Delete a specified node from the linked list • Reverse the linked list
22	Write a program in to create a circular linked list and perform the following operations • Insert a node • Delete a node
23	Write a program to read the name ,age and salary of 5 persons and maintains them in a linked list sorted by name
24	Write a program to merge two singly linked list
25	Write a program to merge two doubly linked list
26	Write a program to implement stack with two dimensional array
27	Write a program to convert an infix expression into its postfix notation
28	Write a program to evaluate a postfix expression
29	Write a program to copy the contents of one stack to another
30	Write a program to implement circular queue as an array
31	Write a program to implement circular queue as a linked list
32	Write a program to implement the followings: • Input restricted deque as an array • Output restricted deque as an array
33	Write a program to implement priority queue as a linked list
34	Write a program that uses both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers: • Linear search • Binary search
35	Write a program to perform the following operations: • Insert an element into a binary search tree • Delete an element from a binary search tree • c) Search for a key element in a binary search tree
36	Write a program to implement the tree traversal methods
37	Write a program to perform the following operations on AVL tree: • Insert an element • Delete an element • Search an element

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ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)

2nd Semester

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)
2nd Semester

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	MCA202201	Theory of Computation	3	0	0	3	30	70
2	MCA202202	Computer Networks	3	1	0	4	30	70
3	MCA202203	Software Engineering	3	1	0	4	30	70
4	MCA202204	Distributed Systems	3	1	0	4	30	70
5	MCA202E1*	Elective-I	3	0	0	3	30	70
Practical								
1	MCA202216	Laboratory DBMS / Web Technology	0	0	8	4	30	70
Bridge Courses [For Non-Computer Students]								
Theory								
1	MCA202B206	Introduction to Web Technology	3	1	0	0	-	100
Practical								
1	MCA202B216	Laboratory Web Technology	0	0	8	0	-	100
TOTAL			**15/18**	**3/4**	**8/16**	**22**	**180**	**420/620**
Total Contact Hours per week: 26/38								
Total Credits: 22								

Elective –I

Sl No	Subject Code	Subjects
1	MCA202E11	Graph Theory
2	MCA202E12	Advanced Data Structures
3	MCA202E1*	Any other subject offered from time to time with the approval of the University

Detail Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202201	**Theory of Computation**	**3-0-0**	**3**

MODULE 1: Sets, Functions and Relations (8 Lectures)

Set: Set, subset, power set, properties of set, operations on sets, products on set, representation of set in computer partitions.

Functions and relation: Binary relation, types of relation, equivalence relation and equivalence class, closure of relation, function, different types of functions.

MODULE 2: Logic and Mathematical Induction (10 Lectures)

Truth tables, algebra of propositions, logical arguments, predicate calculus, recurrence relation.

Principle of counting: Principle of inclusion and exclusion, pigeonhole principle.

MODULE 3: Introductory Concept on Formal logic (8 Lectures)

Revision of propositional and first orders predicate logic, conjunctive normal form, clausal form, Logic programming.

MODULE 4: Concepts of Automata Theory (19 Lectures)

Automata and Languages: Deterministic and non-deterministic Finite Automata, Equivalence of DFA and NFA, Finite automata with ε – transition.

Regular Expressions (RE) and Languages: Building RE, Operations of RE, Conversion of RE to Automata and Automata to RE, Application of RE and its algebraic laws.

Non Regular Languages: Pumping Lemma and its Applications.

Text Books:

1. Trembly,Manohar, Discrete Mathematical Structures
2. J.E.Hopcroft & J.D. Ullman, Introduction to Automata Theory, Languages & Computations, Narosa Publishing House 1999.

References:

1. Liu, C.L. Introduction to Discrete Mathematics
2. S Santha, Discrete Mathematics, Cengage Learning
3. Liu and Mahapatra, Discrete Mathematics, TM
4. KLP Mishra,Theory of Computer Science
5. Anuradha, A Puntambekar: Theory of Computation ----- Technical Publication

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202202	Computer Networks	3-1-0	4

MODULE 1: Introduction **(9 Lectures)**

Introduction: Personal Area Network, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network software, protocol hierarchies, Design issues for the layers, connection oriented vs. Connectionless service, service primitives, relationship of services in protocols, Reference Models, Open System Interconnection (OSI), TCP/IP Reference models, Example Networks: ARPANET, NSFNET, Architecture of Internet. Transmission media: twisted pair, Fiber optic, Comparative study of Categories of cables, Coaxial, optical Fibers, Wireless transmission.

MODULE 2: Data Link Layer **(9 Lectures)**

Design issues, Error detection and correction. Elementary data link protocols: Simplex protocol, stop and wait protocol, simplex stop and wait protocol for noisy channel. Sliding Window protocols, HDLC, PPP and other Data Link control protocols.

MODULE 3: Medium Access Control Sublayer **(5 Lectures)**

The channel allocation problem, multiple access protocols: ALOHA, Carrier sense multiple access protocols, collision free protocols. Wireless LANs, IEEE 802.11 Architecture and Protocol Stack.

MODULE 4: Network Layer **(10 Lectures)**

Design issues, Routing algorithms: Optimality principle, shortest path routing, Flooding, distance vector routing, Link State routing, Congestion Control Algorithms, IP addressing The principles of Internetworking, IPV4, IPv6, ARP, RARP and ICMP.

MODULE 5: Transport Layer **(7 Lectures)**

Transport Services, Elements of Transport protocols, Connection establishment, connection release, Error control, flow control, congestion control, UDP and TCP protocols.

MODULE 6: Application Layer **(5 Lectures)**

Domain name system, Electronic Mail; the World Wide Web, HTTP

Text Books:

1. Andrew S Tanenbaum, David. J. Wetherall, “Computer Networks”, Pearson Education, 5th Edition

Reference Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition
2. Kurose and Ross,Computer Networking-A Top-Down approach, Pearson, 5th edition
3. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Morgan Kaufmann Publishers, 5th Edition, 2011.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202203	**Software Engineering**	**3-1-0**	**4**

MODULE 1: Introduction to Software Engineering (8 Lecturers)
Basic concept of Software Engineering, Waterfall model, Classical waterfall model, Iterative waterfall model, RAD, Prototyping model, Evolutionary model, Spiral model, Agile methodology.
Software Project Management (6 Lecturers)
Planning of a software project; project - control and project team standards; Scheduling, Risk management, Configuration management. Software cost estimation and evaluation techniques.

MODULE 2: Software Design using UML (10 Lecturers)
SRS – different methodologies and techniques
Various design concepts and notations; Modern design techniques; high level design and detailed design; Structured design, object -oriented design
Coding
Standards and guidelines for coding, coding walkthrough, code inspection.

MODULE 3: Software Verification and Validation methods (9 Lecturers)
Documentation and implementation procedures; Performance of software systems; software metrics and models; Documentation of project systems, manuals and implementation.
Testing
Structural Testing, Unit Testing of a test suite etc.

MODULE 4: Software Reliability (6 Lecturers)
Definition and concepts of software reliability; Software errors, faults, repair and availability - re-availability and models; use of database as a case tool. Software Quality Control and Management
- ISO 9000 and CMM - SEI models.

MODULE 5: Software Maintenance (6 Lecturers)
Categories of maintenance; Problems during maintenance; solution to maintenance problems, Maintenance process, Maintenance models, Reverse Engineering, Software Re-Engineering, Estimation of Maintenance costs.
Case Tools.

Text Books/References:

1. RICHARD. Fairley, Software Engineering Concepts, McGraw Hill Publication.
2. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publishing House, 1999.
3. Roger S. Pressman, Software Engineering: A Practitioner's Approach, McGraw Hill Publication.
4. Reference: Rajib Mall, Fundamentals of Software Engineering, Prentice-Hall of India, 1999.
5. Ian Somerville, Software Engineering, Addison Wesley.
6. C. Ghezzi M. Jazayeri and D. Mandrioli, Fundamentals of Software Engineering, Prentice Hall Of India, 1994.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202204	**Distributed Systems**	**3-1-0**	**4**

MODULE 1: Introduction **(5 lectures)**
Introduction to Distributed systems-examples of distributed systems, challenges and goals of distributed system, Distribution Transparency, Distributed System models

MODULE 2: Synchronization **(8 lectures)**
Time and Coordination, physical and logical clock, Synchronizing clock, Christian algorithm, Berkeley Algorithm, Logical time and event ordering. Global state and snapshot algorithms

MODULE 3: Coordination and Agreement (**7 lectures)**
Distributed mutual Exclusion, leader election, termination detection, Consensus and related problems

MODULE 4: Inter Process Communication (**5 lectures)**
Thread in distributed System External data representation and marshalling, Basic RPC operation, Client server communication, Group communication

MODULE 5: Distributed Transaction and Concurrency Control **(8 lectures)**
Flat and Nested Transaction, Distributed deadlock, Edge chasing algorithm, Concurrency control in distributed transaction

MODULE 6: Fault Tolerance in Distributed System **(5 lectures)**
Failure Models, Process Resilience, agreement problems and its applications, commit protocols, voting protocols, check pointing and recovery, reliable communication. Replication and its system models

MODULE 7: Distributed File System **(5 lectures)**
File service architecture, Network File System, Google File System

Textbooks/ Reference books:

1. Distributed Systems Concepts and Design by George Coulouris, Jean Dollimore, Tim Kindberg
2. Distributed System, Principle and paradigms by A Tanenbaum, M V Steen

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E11	Graph Theory	3-0-0	3

MODULE 1: **(5 Lectures)**

Combinatories: Permutations and Combinations; Recurrence relations; Generating functions; Eigen value and Eigen Vectors.

MODULE 2: **(10 Lectures)**

Graph: Incidence and degree; Handshaking Lemma; Isomorphism; Subgraphs and Union of graphs; Connectedness; Walks, Paths and Circuits; Components and Connectedness algorithms; Shortest Path Algorithms, Eulerian graph Fieury's algorithms and Chinese postman problem; Hamiltonian graph - necessary and sufficient conditions; Travelling salesman problem; Bipartite graph

MODULE 3: **(10 Lectures)**

Tree: Properties of trees; Pedant vertices in a tree; Center of a tree; Rooted binary trees; Spanning trees - Spanning tree algorithms; Fundamental circuits Spanning trees of weighted graph ; cut - sets and cut - vertices; Fundamental cut - sets; Connectivity and separativity; Connectivity, K- connectivity Planner graph: Combinatorial and geometric duals; Kuratowski 's graph; Detection of planarity; Thickness crossings, properties of planarity

MODULE 4: **(10 Lectures)**

Colourings: Chromatic number; Chromatic polynomial; The six and five colour theorems; The four colour problem, vertex colouring and upper bounds and its applications, structure of k- chromatic graph, critical graphs, perfect graph, Imperfect graph, perfect graph – theorem Matroids, properties of matroids. Directed graphs: Binary relations; Directed graphs and connectedness; Directed trees; Aborecence; Polish method; Tournaments, matching in bipartite graph Counting of labeled trees: Cayley's theorem; Counting methods; Polya theory

MODULE 5: **(10 Lectures)**

Matrix representations of graph: Incidence; matrices and their properties; Directed graphs; Binary relations; Directed graphs and Application of graphs in computer science

Text Books:

1. Narsing Deo: Graph Theory with Applications to Engineering and Computer Science, PHI(EEE)
2. Agnarsson: Graph Theory: Modeling, Applications and Algorithms, Pearson Education India

Reference Books:

1. Harry, F.: Graph Theory,Addison - Wesley Publ. Comp. 1972.
2. Douglas B. West: Graph Theory, PHI
3. Tremley, J.P. and Manohar, R.P.: Discrete Mathematical Structures with Applications to computer science, McGraw-Hill, 1975.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E12	Advanced Data Structures	3-0-0	3

MODULE 1: Introduction to Algorithms (9 Lectures)

Role of Algorithms in computing, Analyzing algorithm, Designing algorithm, Asymptotic Notations, Summations, Formulas and properties, Recurrences.

Sorting Techniques: Heapsort, Quicksort, Radix sort, Bucket sort, Analysis of sorting techniques

MODULE 2: Search Trees (9 Lectures)

Binary Search Trees, AVL Trees, Red-Black trees, B-Trees, Splay Trees.

Heap Structures: Min/Max heaps, Leftist Heaps, Binomial Heaps, Fibonacci Heaps

MODULE 3: Multimedia Structures (9 Lectures)

Segment Trees, K-D Trees, Point Quad Trees, MX-Quad Trees, R-Trees, TV-Trees

MODULE 4: Problem Solving Techniques (9 Lectures)

Branch & Bound, NP hard and NP complete problems, Huffman Coding, Activity Networks, Flow Shop Scheduling, Randomized Algorithms, Greedy algorithms, Back tracking, Dynamic Programming, Divide and Conquer

MODULE 5: Graph Algorithms (9 Lectures)

Graphic Representation, BFS, DFS, Topological Sort, Connected Components, Minimum Spanning trees, Kruskal's Algorithm, Prims Algorithm – Dijkstra's Algorithm – Floyd's Algorithm, Bellman Ford Algorithm

Pattern Matching and Tries: Pattern matching algorithms-Brute force, the Boyer –Moore algorithm, the Knuth-Morris-Pratt algorithm, Standard Tries, Compressed Tries, Suffix tries

TEXT BOOKS:

1. Data structures, Algorithms and Applications in C++, S.Sahni, University Press (India) Pvt.Ltd, 2nd edition, Universities Press Orient Longman Pvt. Ltd.
2. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and Mount, Wiley student edition, John Wiley and Sons

REFERENCES:

1. Data structures and Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education Ltd., Second Edition.
2. Data structures and algorithms in C++, 3rd Edition, Adam Drozdek, Thomson
3. Data structures using C and C++, Langsam, Augenstein and Tanenbaum, PHI
4. Problem solving with C++, The OOP, Fourth edition, W.Savitch, Pearson Education

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202216	**Laboratory DBMS / Web Technology**	**0-0-8**	**4**

List of Experiments:

Part A: Database Management Systems (*Students will do experiments like the following*)

1. Creation of base tables and views
2. Data Manipulation INSERT, DELETE and UPDATE in Tables. SELECT, Sub Queries
3. Data Control Commands
4. High level language extensions – PL/SQLOr Transact SQL – Packages
5. Use of Cursors, Procedures and Functions
6. Embedded SQL or Database Connectivity
7. Oracle or SQL Server Triggers – Block Level – Form Level Triggers.
8. Working with Forms, Menus and ReportWriters for an application project in any domain.
9. Develop a database application using Java/ PHP/.NET as Front end tool.
10. Design report for following queries:
    (a) Create an anniversary overview based on the hire date of the employees. Sort the anniversaries in ascending order.
    (b) Show the department number and name, and the number of employees working in each department that has fewer than three (3) employees.
11. Design report for following queries:
    (a) Show the department numbers, names and locations of the departments where no sales representatives work.
    (b) Show all employees who have managers with a salary higher than 15000.show the following data: employee name, manager name, manager salary and the salary grade of the manager.
12. Design report for following queries:
    (a) Show the names and locations of all the departments and the number of employees working in each department. Make sure that the departments without employees are included as well.
    (b) Show the department number and name, and number of employees working in each department that has the highest number of employee.

Part B: Web Technology (*Students will do experiments like the following*)

1. College Placement Information System Write a PHP/Java/.NET program to connect to a database and retrieve data from a table and show the details in a neat format.
2. Write a stored procedure in MYSQL and using PHP/Java/.NET code insert or add data into MYSQL table.

3. A simple calculator web application that takes two numbers and an operator (+, ,/,*and %) from an HTML page and returns the result page with the operation performed on the operands.
4. Create an application using HTML, JSP and MySQL Database. HTML file will take data from user which will be inserted, Displayed and stored in database by JSP.
5. Write PHP program
    i. To send mail.
    ii. To convert a string, lower to upper case and upper case to lower case or capital case.
    iii. To change image automatically using switch case.
    iv. To calculate current age without using any pre-define function.
    v. To upload image to the server using html and PHP.
6. Write a code in PHP/Java/.NET to call MYSQL stored procedure with parameters.
7. Write a code in PHP/Java/.NET to execute MYSQL trigger
    i. before insert of values to the table
    ii. delete and edit of a record
8. Demo project (Choose any one): Optional
    i. Student Management System.
    ii. Library Management System
    iii. Hospital Management System
    iv. Online Book Store Project in PHP
    v. Hostel Management
    vi. Online Examination System
    vii. Job portal system
    viii. Event Management System
    ix. Online Pharmacy System

Bridge Courses [For Non-Computer Students]

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202B206	**Introduction to Web Technology**	**3-1-0**	**0**

MODULE 1: Internet Basics (10 Lectures)
Network Connectivity Types- dial up- PPP, SLIP; leased, VSAT, ISP, HTTP, TCP/IP, IP Address, Domain Names, DNS, Services-email, WWW, Search Engine.
Information, Concept of Threading/Multithreading

MODULE 2: Concept of Client –Server Computing (15 Lectures)
Paradigm, Thin Client vs. Flat Client, Middle ware, Client Pull, Server Push, Hypermedia

MODULE 3: Web Client (15 Lectures)
Browser +Architecture, Basic features & Functions, Client-side Inclusive- Scripts, VB Scripts, Java Scripts, ActiveX, ASP, Plugins, Case Study- Netscape Communicator, IE

Textbooks/ Reference books:

1. Asp .net Using VB.net – Wrox Press Ltd - By Cornes, Goode, Sussman, Krishnamoorthy, Miller.
2. Web Technology by Deital & Deital
3. Elmarsi and Navathe, fundamentals of Database Systems, Norsa publishing Company,1989.
4. Silberschatz, Korth and Sudersan, Principles of Database Systems Mc GrawHill Publication

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202B216	**Laboratory Web Technology**	**0-0-8**	**0**

List of Experiments:

1. Write an HTML code
    a. To display your education details in a tabular format.
    b. To display your CV on a web page.
    c. To create a Home page having three links: About Us, Our Services and Contact Us. Create separate web pages for the three links.
    d. To create a login form. On submitting the form, the user should get navigated to a profile page.
    e. To create a Registration Form. On submitting the form, the user should be asked to login with this new credentials.
    f. To create your Institute website, Department Website and Tutorial website for specific subject.
    g. To illustrate the usage of the following:
        i. Ordered List
        ii. Unordered List
        iii. Definition List
    h. To create a frameset having header, navigation and content sections.
    i. To demonstrate the usage of inline CSS.
    j. To demonstrate the usage of internal CSS.
    k. To demonstrate the usage of external CSS.
    l. To prompt for users name and display it on the screen.
2. Design HTML form for keeping student record and validate it using Java script.
3. Write an HTML program to design an entry form of student details and send it to store at database server like SQL, Oracle or MS Access.
4. Write programs using Java script for Web Page to display browsers information.
5. Create an applet which will have a line, an Oval & a Rectangle
6. Writing program in XML and create a style sheet in CSS & display the document in internet explorer.
7. Write an XML program to display products
8. Write a program using PHP and HTML to create a form and display the details entered by the user.
9. Design Student Registration Form In Html
   Create HTML Page named as "sign_up.html" and add the following tags details
    - Form Tag, Paragraph Tag
    - Different Heading Tag, Line Break ,Horizontal line
    - Input tag for text box and submit button
    - Save given page with sign_up.html by choosing „All files" from Save as Type in any respective folder
    - Execute the page by double clicking on name of page from respective folder, It will show result on particular browser (e.g. Mozilla, Chrome, Internet Explorer)
10. Create web page using CSS
11. Create a web page using Bootstrap
    a. Add the HTML5 doctype
    b. To ensure proper rendering and touch zooming, add the following <meta> tag
        i. inside the <head> element:
        ii. <meta name="viewport" content="width=device-width, initial-scale=1">
    c. Include Bootstrap 4 from a CDN
    d. Add Containers
       Bootstrap 4 also requires a containing element to wrap site contents.

There are two container classes to choose from:

- The .container class provides a responsive fixed width container
- The .container-fluid class provides a full width container, spanning the entire width of the viewport.

e. Add Navbar code to insert Menus
f. Add Carousel with caption to display sliding Images (add Images folder to your main folder)
g. Add About us Section with images and Paragraph
h. Add Cards to display blocks.

12. Write JavaScript Program to show light ON/OFF Demo.
13. Write a basic Program in PHP by installing & configuring XAMPP
    i. Download suitable version of XAMPP tool from https://www.apachefriends.org/download.html
    ii. Download Sublime Text 3 Editor from https://www.sublimetext.com/3
    iii. Install XAMPP on „C‟ Drive
    iv. Create new file in that Site (eg C://xampp/htdocs/bikepoint/hello.php) named as hello.php
    v. Write PHP code for displaying hello message
    vi. Execute PHP page as http://localhost/bikepoint/hello.php in web browser

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ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)

3rd Semester

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)
3rd Semester

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	MCA202301	Artificial Intelligence and Machine Learning	3	1	0	4	30	70
2	MCA202302	Web Technology and Services	3	1	0	4	30	70
3	MCA202303	Introduction to Data Science	3	1	0	4	30	70
4	MCA202E2*	Elective-II	3	0	0	3	30	70
5	MCA202E3*	Elective-III	3	0	0	3	30	70
Practical								
1	MCA202324	Mini Project and Seminar	0	1	6	4	30	70
TOTAL			**15**	**4**	**6**	**22**	**180**	**420**
Total Contact Hours per week: 25								
Total Credits: 22								

Elective –II

Sl No	Subject Code	Subjects
1	MCA202E21	Compiler Design
2	MCA202E22	Advanced Computer Architecture
3	MCA202E23	Cryptography and Network Security
4	MCA202E24	Microprocessors
5	MCA202E25	Optimization Techniques
6	MCA202E2*	Any other subject offered from time to time with the approval of the University

Elective –III

Sl No	Subject Code	Subjects
1	MCA202E31	Information retrieval Systems
2	MCA202E32	Soft Computing
3	MCA202E33	Unix Network Programming
4	MCA202E34	Big Data Analytics
5	MCA202E35	Embedded Systems
6	MCA202E3*	Any other subject offered from time to time with the approval of the University

Detail Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202301	**Artificial Intelligence and Machine Learning**	**3-1-0**	**4**

MODULE 1: Introduction to AI
Meaning and definition of AI, Relationship between AI and machine learning, the foundation of AI (1940-present), Intelligent Agent: definition, how agent work, structure of Agent, example of Agent, Problem solving Agent, Goal based agent, Simple reflex Agent, Environment and properties of Agent, Definition of state and actions.

MODULE 2: Problem Solving with AI Techniques
Problem solving environment, 8 Puzzle problem, Crypt arithmetic, Missionaries and cannibal, Real world problem, Route finding, Travelling salesman problem, searching strategy, Breadth First Search, Uniform Cost search, Depth First Search, Bidirectional Search, Best First Search, Greedy Search A*, Heuristic functions, iterative improvement algorithm, Hill Climbing search, Forward and Backward chaining, Game Tree search, Minimax, Alpha, Beta, Heuristic in Game Tree Search.

MODULE 3: Knowledge Representation with Grammar
Knowledge base Agent, Knowledge base sentence, knowledge representing Language, Inference, Background knowledge, Propositional Logic, Syntax, Semantics, Validity, Inference Rules models, First Order Logic, Syntax, Semantics, Terms Atomic sentence, Complex sentence, Quantifiers, Nested quantifiers, Equality, Kinship Domain, Axioms, Definitions and Theorem, Universal Eliminations, Existential Elimination, Generalized Modus Ponens, Higher Order Logic – Functional and Pedi care expressions, uniqueness quantifier, operator, notational variations.

MODULE 4: Expert System
Definition of Expert System, Characteristics of Expert System, Components of Expert System, Application of Expert Systems.

MODULE 5: Introduction to Machine Learning
Definition, need of machine Learning, Types of Machine Learning, Association Rule Mining- Introduction Techniques, Supervised Techniques, Classification and Regression, Unsupervised Techniques, Clustering Ensembles Methods and Techniques, Algorithms, Decision Tree, Naïve, Bayes, Nearest Neighbor Estimation, A simple Classifier, Perceptron, K-means.

MODULE 6: Tensorflow OR R
Tensor Flow: Introduction, Installation, Basic – Data structure, Dimensions, Machine Learning, Algorithm, Implementation, Visualization, Word Embedding, Exporting dataset to Tensor Flow, Forming Graph. R-introduction to R, Vectors, Vectorised operations, Functions in R, Package in R, Matrices, Arrays and List operations, Acessing List Components and values, Applying Functions.

Text Books/Reference Books:

1. Staurt J Russel and Peter Norvig: "Artificial Intelligence: A Modern Approach", Pearson Education 2005.
2. Elaine Rich and Kelvin Knight, "Artificial Intelligence" TMGH 2002
3. Avron Barr and Edward A, Feigenbaum, "Handbook of Artificial Intelligence" CSE Deptt, Stanford Univ.
4. Alex Smola and SVN Vishwanathan, "Introduction to Machine Learning", Cambridge University
5. Nills J Nilson, "Introduction to Machine Learning" Deptt of CSE, Stanford University 1998
6. Shai Shalev Swartz, Sahi Ben David "Understanding Machine Learning From theory to Algorithms" Cambridge University Press 2014.
7. Tom M Mitchelli, "Machine Learning" MGH 1997
8. R Akerkar "Introduction to Artificial Intelligence"

9. Norman Matloff, “The Art of R- Programming “A tour of statistical Software design” No startch 2011
10. Jared P lander, “R for everyone, Adavanced Analytics and graphics”AW, Data analysis series 2013.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202302	Web Technology and Services	3-1-0	4

MODULE 1: Introduction to Web Technology

Introduction to web technology: The World Wide Web, www Architecture, Web Search Engine. Web Crawling, Web Indexing, Web Searching, Search Engine, Optimization and Limitations, Introduction to the Semantic Web.

Introduction to Web Services: Web Service, Software as a Service, Web Service, Architectures, SOA Service Oriented Architecture, XML (Extensible Markup Language)

MODULE 2: Web Application Development

Web Application Development: introduction to PHP (Hypertext Preprocessor), syntax, variables, strings, operators, Loops, array, Built-in Functions, User-Defined Functions, Processing Forms, Using PHP Includes, Database Connectivity-JDBC, ODBC, Regular Expressions, Sending Mail, Object-Oriented PHP, Cookies and Sessions, File Uploads.

Bootstrap: introduction to bootstrap, color management, buttons, table, drop-down, navigation-bar, images, pagination, jumbotron, alert, forms, progress bar, grid, utilities and filters.

MODULE 3: Web Security

Web security: Issues and principles, Security model, Confidentiality, authentication, Integrity, Non-repudiation, Access Control, and Availability. Sniffing, spoofing, phishing, pharming, Cryptography, Cipher Text, Digital Signature, Digital Certificates;

Network security: SSL, Firewalls, Tunnels, IP Security, X-HTTP, IPV4 & IPV6 security.

MODULE 4: Web Services and Web Object Model

Web Services & Middleware: Concept and functions, CORBA, DCOM & CORBA, Service Oriented Architectures: web services, SOAP architecture

Web Object Model: CORBA, COM, DCOM, IIOP.

MODULE 5: Frameworks and Web Content Management Systems

Different Frameworks in web development: MVC, Front-end and Back-end Framework: concepts, functions and features; **Front-end Framework**: React JS, Angular JS etc.; **Back-end Framework**: Django, Flask, Laravel, Ruby on Rails, Node JS etc.

Web Content Management Systems: Joomla, WordPress, Drupal - Content creation using the CAM Model, Content customization images, video, audio, tags, formats, etc., Adding and displaying menus, Linking menus to articles and other features.

Web Applications Case Studies: Cloud computing, IOT, Application of Artificial Intelligent (AI) in Web, E-Commerce

Text Books/References:

1. Web Technology by Deital & Deltal.
2. Php: The Complete Reference 1st Edition (Steven Holzner).
3. Mastering Bootstrap 4 (Jakobus Benjamin)

Online reference.

1. https://wwwjoomla.org/
2. https://wordpress.com/
3. https://www.drupal.org/

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202303	**Introduction to Data Science**	**3-1-0**	**4**

MODULE 1: Introduction to Statistic for Data Science

Descriptive Statistics (Sampling Techniques, Measure of Central Tendency, Measure of Variation), Correlation and Regression (Karl's Pearson Correlation Coefficient, Rank Correlation, Bivariate Frequency Distribution, Regression Coefficient), Probability Theory, Distribution Function (Random Variable, Probability Mass Function and Probability Density Function, Probability Distribution (Binomial Distribution, Poisson Distribution, Continuous Probability Distribution), High Dimensional Space- Introduction, Geometry of High Dimension, Markov Law of Large Number.

MODULE 2: Introduction to Data Mining

Data Preprocessing Steps: Data cleaning, Data Transformation, Data Reduction; Measure of Similarity and Dissimilarity: Euclidean, Manhattan, Jaccard, Makowski; Feature Selection (Filter, Wrappers), Dimensionality Reduction (Feature Embedding, Factor analysis, PCA and LDA;Supervised and Unsupervised Learning

MODULE 3: Algorithms

Classification Techniques - Decision Tree, Rule Based Classifier, Probabilistic Classifier, and K Nearest Neighbor; Association Rule Mining: APriori, FP Growth; Clustering Techniques- K Mean, Hierarchical Clustering Algorithm, DBSCAN, Partitioning Method, CLARANS, CLIQUE; Genetic Algorithm, Temporal Models, Time Series Model (ARMA); Ensemble Method- Bagging, Random Forest, Adaptive Boosting, Gradient Boosting.

MODULE 4: Deep Learning Computation

Layer and Blocks, Custom Block, Sequential Block: Parameter Management (Access, Initialization, Tied Parameter), Deferred Initialization, Custom Layer (Layer with Parameter, Layer without parameter)

MODULE 5: Artificial Neural Network

Introduction, Basic concepts of artificial neural networks, Earlier neural networks: ADALINE, MADALINE. Neural Network Architectures: Single layer feedforward network, Multilayer feedforward network, Recurrent network

MODULE 6: Natural Language Processing

Introduction, Grammar Checkers, The different analysis levels- Morpho Lexical, Syntactic, Semantic (Networks, Parsers), Pragmatic (Knowledge Representation, Reasoning, Plan and Goal Recognition), Lexical level (Error Tolerant Lexical Processing), Syntactic Level (Logical Focus, Ambiguity Resolution)

Books/ Reference:-

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
5. Gupta, S.C. and Kapoor, V.K.: "Fundamentals of Mathematical Statistics", Sultan & Chand & Sons, New Delhi, 11th Ed, 2002.
6. Hastie, Trevor, et al. "The elements of Statistical Learning", Springer, 2009.
7. Ross, S.M., "Introduction to Probability and Statistics",Academic Foundation, 2011.
8. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
9. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.
10. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E21	Compiler Design	3-0-0	3

MODULE 1: Overviews
The structure of a Compiler, Applications of Compiler Technology, Programming Language Basics, Syntax Definition, Syntax-Directed Translation, Parsing, Translator for Simple expressions, Lexical Analysis, Symbol Tables, Intermediate Code Generation

MODULE 2: Lexical Analysis
Specification of Tokens, Strings and Languages, Regular Expressions, Recognition of Tokens, Use of Lex, Finite Automata

MODULE 3: Syntax Analysis
Role of the Parser, Parse trees and derivations, Top-Down parsing, Recursive-Descent Parser; bottom-up parsing, Operator precedence parser, LR parsers- SLR and LALR, Handling Ambiguity
Syntax-Directed Translation: Evaluation of SSD, Construction of Syntax Trees

MODULE 4: Intermediate-Code Generation & Code Optimization
Semantic analysis, Attribute grammars, Type checking, Type Conversions and Overloading, Symbol tables for compilers. Runtime Environments: Activation records, heap management, garbage collection Error detection and recovery.
Code Optimization: Basic Blocks and Flow Graphs, Optimization of Basic Blocks, Peephole Optimization.

MODULE 5: Introduction to Data-Flow Analysis
Register allocation, Loop optimization, Instruction Scheduling and Software Pipelining, Automatic Parallelization

Text Books/ References:

1. Aho A. Ravi Sethi and D Ullman. Compilers – Principles Techniques and Tools, Addison Wesley, 2006.
2. D. M.Dhamdhare, System Programming and Operating Systems,Tata McGraw Hill &Company, 1996.
3. Kenneth C. Louden, Compiler Construction – Principles and Practice, Cengage Learning Indian Edition, 2006.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E22	Advanced Computer Architecture	3-0-0	3

MODULE 1: Introduction to Parallel Processing
Parallel processing trends, Levels of parallel processing, parallelism in uniprocessor systems- parallel processing mechanisms
Parallel Computer Structures: Pipeline computers, Array processors, Multiprocessor systems, Architecture classification schemes- Flynn's, Feng's and Handler's classifications

MODULE 2: Pipelining in Uniprocessors
Linear pipelining principles, Classifications of pipeline processors, Instruction and arithmetic pipelines, Principles of designing pipeline processors-Instruction prefetch, branch handling, forwarding, Hazards and its types, hazards detection and resolution.

MODULE 3: Vector Processing
Vector processing requirements, pipeline computers and vectorization methods, Various vector processors- STAR 100, CRAY-1, CYBER-205, Fujitsu 200 and their special features.

MODULE 4: Structures and Algorithms for Array Processors
SIMD Array Processors, SIMD interconnection networks, Parallel algorithms for array processors, SIMD computers and their performance enhancement

MODULE 5: Multiprocessor Architecture and Programming
Functional structures, interconnection networks, parallel memory organizations, multiprocessor control and algorithms, interprocess communication mechanism, system deadlocks and protection, multiprocessor scheduling strategies, parallel algorithms for multiprocessor- synchronous and asynchronous.

MODULE 6: Data Flow Computer
Data driven computing and languages, advantages and potential difficulties etc.

Text books / Reference Books:

1. Computer architecture and parallel processing by Kai Hwang, Faye A. Briggs
2. Computer system architecture by M. Morris Mano.
3. Advanced Computer Architecture by Kai Hwang.
4. Parallel processing system by Evans. D.J.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E23	Cryptography and Network Security	3-0-0	3

MODULE 1: Introduction

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

MODULE 2: Symmetric Key Cryptography Mathematics of Symmetric Key Cryptography

Algebraic structures - Modular arithmetic-Euclid‟s algorithm- Congruence and matrices - Groups, Rings, Fields- Finite fields- Symmetric Key Ciphers: SDES – Block cipher Principles of DES – Strength of DES – Differential and linear cryptanalysis - Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard - RC4 – Key distribution.

MODULE 3: Public Key Cryptography Mathematics of Asymmetric Key Cryptography

Primes – Primality Testing – Factorization – Euler‟s totient function, Fermat‟s and Euler‟s Theorem - Chinese Remainder Theorem – Exponentiation and logarithm - ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange - Elgamal cryptosystem – Elliptic curve arithmetic-Elliptic curve cryptography

MODULE 4: Message Authentication and Integrity

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications - Kerberos, X.509

MODULE 5: Security Practice and System Security

Electronic Mail security – PGP, S/MIME – IP security – Web Security - SYSTEM SECURITY: Intruders – Malicious software – viruses – Firewalls.

Text Books/Reference Books:

1. Cryptography and Network Security, 3rd Edition Behrouz A Forouzan, Deb Deep Mukhopadhyay, McGraw Hill
2. Cryptography and Network Security, William Stallings, (6e) Pearson.
3. Everyday Cryptography, Keith M.Martin, Oxford
4. Network Security and Cryptography, Bernard Meneges, Cengage Learning

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E24	Microprocessors	3-0-0	3

MODULE 1: Introduction to Microprocessor System

Evolution of Microprocessors, Historical background- reason behind microprocessor technology, Intel Microprocessor family: 4004 to Pentium, Main components of a microprocessor based system; Function of a microprocessor

MODULE 2: Introduction to 8085 Microprocessor Architecture

CPU, address bus, data bus and control bus. Input/Output devices, buffers, encoders, latches and memories. Internal Data Operations and Registers, Pins and Signals, Peripheral Devices and Memory Organization, Interrupts

MODULE 3: 8085 Microprocessor Instructions

Classification, Format and Timing. Instruction Set: 8 Bit and 16 Bit Instructions, Programming and Debugging, Subroutines

MODULE 4: 8085 Microprocessor Interfacing

8259, 8257, 8255, 8253, 8155 chips and their applications, A/D conversion, memory, keyboard and display interface (8279)

MODULE 5: 8086 Microprocessor Architecture and Instruction Set

Architecture of Intel8086 (Bus Interface Unit, Execution unit),register organization, memory addressing, memory segmentation, Operating Modes.

Instruction Set: Addressing Modes: Instruction format: Discussion on instruction Set: Groups: data transfer, arithmetic, logic string, branch control transfer, processor control. Interrupts- Hardware and software interrupts, responses and types

Textbook and References:

1. Gaonkar R,“ Microprocessor Architecture, Programming and Applications with the 8085”, Penram International.
2. Hall D.V.,“ Microprocessors and Interfacing”, Tata McGraw-Hill Publishing Company Limited.
3. Short K. L.,“ Microprocessors and Programmed Logic”, 2nd Ed.,Pearson Education

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E25	Optimization Techniques	3-0-0	3

MODULE 1: Introduction
Introduction to Linear Programming Problem (LPP), Graphical method, simplex method, Two Phase method, degeneracy, alternative optima, Graphical sensitivity analysis

MODULE 2: Linear Programming
LP-Duality and Sensitivity Analysis: Definition of Dual, Primal-Dual Relationships, Dual Simplex Sensitivity or Post Optimal Analysis.

MODULE 3: Advanced Linear Programming
Revised Simplex Method, Bounded-Variable Algorithm, Duality, Parametric programming

MODULE 4: Integer Programming
Formulation and Applications-Cutting Plane Algorithm-Branch and Bound Method.

MODULE 5: Deterministic Inventory Models
EOQ models, EOQ with price breaks, Multi-Item EOQ with storage limitation.

MODULE 6: Queuing Systems
Pure birth and Pure death models, generalized Poisson queuing model, single server models.

Textbooks/ Reference Books:

1. Operations Research- An Introduction, by Hamdy A.Taha , 9th Edition, Pearson Education – 2012
2. Optimization Techniques, by L.R.Foulds, Springer ,Utm , 1981.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E31	Information retrieval Systems	3-0-0	3

MODULE 1: Introduction
Basic of IR, the retrieval process, Architecture of IR system
IR Models: Taxonomy of IR models, Document retrieval and ranking, Boolean retrieval model, Vector space retrieval model, Probabilistic model, Text similarity matrices – TF IDE weighting and cosine similarity

MODULE 2: Tokenizing, Indexing and Implementation of Vector Space Retrieval
Simple Tokenizing, word tokenization, Text tokenization, stop word removal, word stemming, indexing architecture
Evaluation of IR: Relevance and Retrieval, Performance matrices, Basic measures of text retrieval

MODULE 3: Query Operation and Languages
Relevance feedback and pseudo relevance feedback, Query expansion and its types, Query language, Text representation using markup languages

MODULE 4: Text Categorization and Clustering
Categorization algorithms, Clustering algorithms, Application to information filtering, Hadoop, Map reduce

MODULE 5: Web Search and Link Analysis
Working principle of Search engine, Basic crawler architecture, web crawling, Link analysis, page ranking, XML retrieval, semantic web, Trends and research issues

Text Books/ Reference Books:

1. An introduction to information retrieval. C. Manning, P.Raghavan,H.Schutze, Cambridge University press
2. Baeza-Yates and Ribeiro-Neto, Modern Information Retrieval, Addison Wesley
3. Bruce Croft, D. Metzler, T. Strohman, Search Engines Information Retrieval in Practice Pearson. Stefan Büttcher, Charles L. A. Clarke and Gordon V. Cormack, Information Retrieval Implementing and Evaluating Search Engines. MIT Press

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E32	Soft Computing	3-0-0	3

MODULE 1: Artificial Neural Networks

Introduction, Perception -Representational Power of Perception, The Perceptron Training Rule, Multilayer Networks and Backpropagation Algorithm- Convergence and Local Minima, Feedforward Networks, Hypothesis Space Research, Hidden Layer Representation, Alternative Error Function, Recurrent Network.

MODULE 2: Fuzzy Logic

Crisp set and Fuzzy set, Basic concepts of fuzzy sets, Fuzzy set operations, Fuzzy Arithmetic-fuzzy numbers, Fuzzy ordering, Fuzzy vectors. Fuzzy measures-belief and plausibility measure. Probability Measure-Measure of fuzziness, Fuzzy integrals. Membership functions: Features of membership function, Fuzzification. Fuzzy Rule Based Systems: Fuzzy proposition, Formation and decomposition of rules, Fuzzy reasoning, Fuzzy inference systems, Fuzzy expert system. Defuzzification: Maxmembership, Centroid method, Weighted average, Mean max.

MODULE 3: Multi-Objective Optimization Problem Solving

Introduction to multi-objective optimization problems (MOOPs). MOOPs issues, Multi-Objective Evolutionary Algorithm (MOEA), Non-Pareto and Pareto based approaches to solve MOOPs

MODULE 4: Genetic Algorithms

Traditional optimization and search techniques, Genetic algorithms. Operators: Encoding, Selection, Crossover, Mutation. Classification: Adaptive genetic algorithms, Hybrid genetic algorithms, Parallel genetic algorithms, Real coded genetic algorithm

MODULE 5: Hybrid Systems

Neuro fuzzy hybrid systems, Adaptive neuro-fuzzy inference systems, Fuzzy backpropagation network, Genetic neuro hybrid system, Genetic algorithm based backpropagation network, Genetic fuzzy hybrid systems.

Textbooks/ Reference Books:

1. Soft Computing by Saroj Kaushik and Sunita Tewari, McGraw Hill
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani: Neuro-fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, PHI Learning.
3. Introduction to Soft Computing, Neurofuzzy and Genetic Algorithms, Samir Roy, Udit Chakraborty, Pearson Education
4. Satish Kumar: Neural Networks, A Classroom Approach, 2nd Edition, Tata McGraw-Hill Education

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E33	Unix Network Programming	3-0-0	3

MODULE 1: Overview of System Programming
Unix History; Fundamental Concepts; System Programming Concepts; Unix File I/O; Standard I/O Library; fcntl; ioctl; Unix Processes; Program Execution; Error Handling; Unix Signals
Unix Inter Process Communication: Unix IPC, Pipes, FIFOs, System V Message queues, System V Semaphores, System V Shared Memory, Memory mapping

MODULE 2: UNIX Inter Process Communication
Unix IPC, Pipes, FIFOs, System V Message queues, System V Semaphores, System V Shared Memory, Memory mapping

MODULE 3: Socket Programming
Overview of Transport Layer Protocols: TCP, UDP; Client- server architectures; Sockets, Sockaddr structure; TCP and UDP Socket API; TCP client-server examples; UDP examples; Socket Options; Domain name conversion API; IPv6 differences; IPv4-IPv6- compatibility; Choice: TCP or UDP; Adding reliability to UDP applications; Protocol Implementation Issues: encoding, framing; Case study: HTTP, CGI; Windows Socket API; Java Socket API

MODULE 4: UNIX I/O Models
Non-Blocking I/O; I/O multiplexing; Signal driven I/O; Asynchronous I/O (POSIX API); Client and server design with select() call; shutdown(); Advanced I/O API
Unix Domain Protocols: Daemons; Addressing; Socket pair; Descriptor passing; User credentials; Credential passing; Daemon processes; inetd super server, sylogd

MODULE 5: Client-Server Design Alternatives
Overview of Pthreads; Pthreads Synchronization; Non-blocking I/O; Non-blocking connect; Client alternative designs; Performance analysis; Preforking models; Prethreading models; Performance analysis; Case study: Apache; The C10K problem; Event- driven architectures; Concurrency models for UDP servers

MODULE 6: Multicasting and Broadcasting
Concepts & implementation, broadcasting & multicasting in IPv6; Raw sockets, Data link access Socket creation; input, output; ping: design & implementation; trace route: design & implementation; UDP asynchronous errors; Distributed Programming SUN RPC: high level API; port mapper; rpcgen; XDR; lowlevel API: authentication; multithreading; Overview: DCE- RPC, DCOM, Java RMI, CORBA; Web-based RPC overview: XML-RPC, SOAP

MODULE 7: Network Programming in JAVA
Network basics, TCP sockets, UDP sockets (datagram sockets), Server programs-single threaded server, multithreaded server, Remote Method Invocation (Java RMI)-Basic RMI Process, Implementation details-Client-Server Application

Text Books/Reference Books

1. W. R. Stevens, UNIX Network Programming, Vol I, Networking APIs: Sockets and XTI, PearsonEducation, 3rd Edition.
2. W.R.Stevens, UNIX Network Programming, Interprocess Communication, Vol II Pearson Education, 2nd Edition.
3. The Linux Programming Interface: Linux and UNIX System Programming Handbook by Michael Kerrisk, No Starch Press © 2010

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E34	Big Data Analytics	3-0-0	3

MODULE 1: Introduction to Big Data
Problems of Traditional Data, Definition of Big Data, Source of Big Data, 5V's concept, Characteristics and Types of Big data, Real Life Examples of Big Data, Applications and Tools of Big Data, Challenges, Introduction of Hadoop, Big Data Vs Hadoop, ***Case Study 1*** –IBM Big Data Strategy

MODULE 2: Introduction to HADOOP
History of Hadoop, Module of Hadoop, Architecture of Hadoop, Namenode and Datanode of Hadoop, Core Components- Map Reduce, Hive, Pig and HBase, Hadoop Streaming. Hadoop Ecosystem, Installation of Hadoop, ***Case Study 2*** –Getting started with Hadoop and Loading Data in Hadoop.

MODULE 3: HADOOP Distributed File System (HDFS)
The design of HDFS, HDFS Concept, Hadoop File System Interface, Data Flow, data Ingest with Flume and Sqoop, Hadoop I/O-Compression, Serialization, Avro and File Based Data Structure, HDFS Features and Goals, YARN-Components and Benefits, ***Case Study 3***-Time Series Analysis in Context of Big Data.

MODULE 4: Map Reduce
Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features, ***Case Study 4*** –Big Data Study On Netflix Data Communication.

MODULE 5: HADOOP Eco System
PIG-Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing Operators, Hive –Hive Shell, Hive Services, Hive Metastore, Comparisons with Traditional Databases, HiveQl, Tables, Querying Dataand User Defined Functions, HBase-Hbasics,Concepts, HBasevs RDBMS, ***Case Study 5*** –WALMART work procedure using Big Data

Textbooks/Reference Books:

1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
2. Tom White "Hadoop: The DefinitiveGuide" Third Edit on, O'reily Media, 2012.
3. ArvindSathi, "BigDataAnalytics: Disruptive Technologies for Changing the Game", MC Press, 2012.
4. Pete Warden, "Big Data Glossary", O'Reilly, 2011

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202E35	Embedded Systems	3-0-0	3

MODULE 1: Introduction to Embedded Systems
Definition of Embedded System, Embedded System Vs General Computing Systems, History, Classification based on generation, complexity etc. Major application areas. Purposes/specific features, recent trends.

MODULE 2: Embedded System Architecture
Hardware architecture, its different components with functionality. Different types of processors used their trade-offs features Examples of Domain specific embedded systems with examples e.g. working of Washing machine automobile etc. Networking concept in embedded system Different buses used I2C PCI CANetc. Software architecture, Embedded operating system architecture categories of embedded operating system, Application software options with high level and assembly level language and different tools used for software development. Process of creation of ROM image/firmware design Study of some microcontroller/processor 8051 / PIC /AVR /ARM/DSP study of Embedded readymade boards like Adriano Raspberry implementing small projects

MODULE 3: Design
Process of Embedded System Development, Different models, waterfall model, requirement analysis, design tradeoffs, hardware software co design different hardware platforms – single board PC add on cards custom made hardware platforms. communication interfaces RS232 RS422 USB Infrared IEEE 1394 firmware Ethernet IEEE 802.11 Bluetooth Embedded firmware design creation of ROM image

MODULE 4: Programming
Different programming options Assembly High level for Embedded systems. Requirement of Embedded real time Operating Systems its features implementation

MODULE 5: Development and Testing
Testing of Embedded systems, Embedded product development life cycle EDLC and its importance, Latest trends in Embedded industry, Fundamental concept in RT Linux and Navigation Systems

Text Books/References:

1. Introduction to Embedded Systems Shibu K V Mc Graw Hill Education
2. Embedded Systems Architecture programming and design Raj Kamal Tata Mc Graw Hill
3. Embedded Real Time Systems concept design and programming K V K K Prasad Dreamtech
4. 8051 microcontrollers and embedded Systems Mazidi and Mazidi

Course Code	Course Title	Hours per week L-T-P	Credit C
MCA202324	Mini Project and Seminar	0-1-6	4

Mini Project: Development of WEB/Android /Embedded / Database Application Systems (12 weeks)

Seminar: Advanced/Recent topics of Computer Science/Engineering selected by the faculty

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ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)

4th Semester

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure
(From Academic Session 2020-21 onwards)

MASTER OF COMPUTER APPLICATIONS (MCA)
4th Semester

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	MCA202E4*	Elective-IV	3	0	0	3	30	70
2	MCA202E5*	Elective-V	3	0	0	3	30	70
Practical								
1	MCA202421	Major Project	-	-	32	16	100	100
TOTAL			**9**	**0**	**32**	**22**	**160**	**240**
Total Contact Hours per week: 41								
Total Credits: 22								

NOTE: Elective-IV and Elective-V are to be taken from MOOCs-SWAYAM/NPTEL/AICTE approved online courses

Elective–IV (Online Mode)

Sl No	Subject Code	Subjects
1	MCA202E41	Mobile Computing
2	MCA202E42	Image Processing
3	MCA202E43	Remote Sensing and GIS
4	MCA202E4*	Any other appropriate approved online courses with the approval of the University

Elective–V (Online Mode)

Sl No	Subject Code	Subjects
1	MCA202E51	Internet of Things
2	MCA202E52	Cloud Computing
3	MCA202E53	Bioinformatics
4	MCA202E54	Simulation and Modelling
5	MCA202E5*	Any other appropriate approved online courses with the approval of the University

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