Syllabus

For

Master of Computer Application

With Lateral Entry

Dibrugarh University

Under

Choice Based Credit System

CHOICE BASED CREDIT

SYSTEM
MASTER OF COMPUTER APPLICATION

Master of Computer Application
Syllabus Structure

1st Semester:

Course	*Title of the Paper*	*Credits*			
		L	***T***	***P***	***Total***
MCA 101	Discrete Mathematics	3	1	0	4
MCA 102	Computer Programming and Problem Solving	3	0	0	3
MCA 103	Digital Design	3	0	0	3
MCA 104	Organizational Behaviour	3	1	0	4
MCA 105	Accounting and Financial Management	3	1	0	4
MCA 106	Programming Lab – I A	0	0	1	1
MCA 107	Programming Lab – I B	0	0	1	1
Total Credit					20

2nd Semester:

Course	*Title of the Paper*	*Credits*			
		L	***T***	***P***	***Total***
MCA 201	Numerical Analysis and Statistical Techniques	3	0	0	3
MCA 202	Data and File Structures using C++	3	0	0	3
MCA 203	Computer Organization and Architecture	3	0	0	3
MCA 204	Object Oriented Programming and Design	3	0	0	3
MCA 205	Quantitative Graph Theory: Mathematical foundations	3	0	0	3
MCA 206	Programming Lab – II A	0	0	3	3
MCA 207	Programming Lab – II B	0	0	2	2
MCA 208	Oral and Written Communication	Audit Course			
Total Credit					20

3rd Semester:

Course	*Title of the Paper*	*Credits*			
		L	***T***	***P***	***Total***
MCA 301	Formal Language and Automata	3	1	0	4
MCA 302	Database Management System	3	0	0	3
MCA 303	Object Oriented Programming using Java	3	0	0	3
MCA 304	Operating Systems	3	0	0	3
MCA 305	Software Engineering	3	1	0	4
MCA 306	Programming Lab – III A	0	0	1	1
MCA 307	Programming Lab – III B	0	0	2	2
MCA 308	Introduction to Data Science	Audit Course			
Total Credit					20

4th Semester:

Course	*Title of the Paper*	*Credits*			
		L	***T***	***P***	***Total***
MCA 401	Artificial Intelligence	3	1	0	4
MCA 402	Optimization Technique and Queuing Theory	3	0	0	0
MCA 403	Data Communication and Computer Network	3	1	0	4
MCA 404	Elective – I*	3	0	0	3
MCA 405	Elective – II*	3	0	0	3
MCA 406	Lab – IV A	0	0	1	1
MCA 407	Lab – IV B *	0	0	2	2
MCA 408	Minor Project and Project Writing	Audit Course			
Total Credit					20

********for Course MCA 414 in Elective-I, total credit shall be 4.*

Elective Courses:

MCA 404 - Elective – I:

MCA 414 - Parallel and Distributed Computing (L: 3, T: 1, P: 0)
MCA 424 - Embedded System
MCA 434 - Microprocessor Based System

MCA 405 - Elective – II:

MCA 415 - Advanced DBMS
MCA 425 - System Software
MCA 435 - Data Mining and Warehousing

MCA 407 - Lab – IV B:

MCA 4247 - Lab – IV B (ES)
MCA 4347 - Lab – IV B (MBS)
MCA 4157 - Lab – IV B (ADBMS)
MCA 4257 - Lab – IV B (SS)
MCA 4357 - Lab – IV B (DMW)

5th Semester:

Course	*Title of the Paper*	*Credits*			
		L	***T***	***P***	***Total***
MCA 501	Design and Analysis of Algorithms	3	1	0	4
MCA 502	Web Designing	3	0	0	3
MCA 503	Computer Graphics and Multimedia	3	0	0	3
MCA 504	Elective – I*	3	1	0	4
MCA 505	Elective – II*	3	0	0	3
MCA 506	Lab – V A	0	0	2	2
MCA 507	Lab – V B*	0	0	1	1
Total Credit					20

Elective Courses:

MCA 504 - Elective – I:

MCA 514 - Fuzzy Sets and Applications
MCA 524 - Machine Learning
MCA 534 - Pattern Classification
MCA 544 - Cloud Computing
MCA 554 - GIS & Remote Sensing

MCA 505 - Elective – II:

MCA 515 - Internet Security
MCA 525 - Internet of Things
MCA 535 - Network and System Administration

MCA 507 - Lab – V B:

MCA 517 - Lab – V B (IS)
MCA 527 - Lab – V B (IoT)
MCA 537 - Lab – V B (NSA)

6th Semester:

Course	*Title of the Paper*	*Total Project duration and Work hours*	*Credits*
MCA 601	System Development Project (Internal Evaluation)	15 weeks to be devoted for the project work	8
MCA 602	System Development Project (External Evaluation)		16
Total Credit			24

*The electives chosen by the students from the curriculum shall be offered, provided that a minimum number of students, to be fixed by the department concerned registered for the same.

Detailed Syllabus

Course No:	*Title of the Paper:*	*Credits*			
MCA 101	Discrete Mathematics	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Provide tools from the topics of Discrete Mathematics for analysis and design of computer hardware and computer software.
- Provide the foundation for imbedding logical reasoning in computer science from the topics of propositional calculus.
- Provide tools to reason for the efficiency of an algorithm.

Prerequisite:

Before proceeding with this course, the students should be familiar with mathematics.

Learning Outcome:

On completion of the course, students will be able to:

- Learn some fundamental mathematical concepts and terminology.
- Write an argument using logical notation and determine if the argument is or is not valid.
- Use recursive definitions.
- Count some different types of discrete structures.
- Demonstrate an understanding of relations and functions and be able to determine their properties.
- Model problems in Computer Science.
- Learn techniques for constructing mathematical proofs, illustrated by discrete mathematics examples.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Set **10 L**

Basic concepts of set, terminology, notation; Operation on sets, Algebra of sets, Countable and Uncountable set, Fuzzy set, Computer representation of sets.

Unit II: Relations and function **10 L**

Relations, equivalence relations, Types of relation, properties of relation; Function, classification of functions, types of function, Some special functions ;

Unit III: Logic **10 L**

Logic operators, Truth table, Normal forms, Theory of inference and deduction, Mathematical induction, Predicate calculus; predicates and quantifiers.

Unit IV: Combinatorics **10 L**

Basic counting techniques, Recurrence relations and their solutions. Generating functions.

Unit V: Ordered sets **10 L**

Introductions, Ordered sets, Hase Diagrams of Partially Ordered sets, consistent enumerations supremum and infimum, isomorphic ordered sets well-ordered sets,

Unit VI: Lattice **10 L**

lattices, bounded lattices, distributive lattices, complements, complemented lattices

Text Books:

1. Kenneth H. Rosen : Discrete Mathematics and Its Applications, Mcgraw-Hill College; 6th edition (January 5, 2006).
2. Biggs N.L., "Discrete Mathematics", 2nd Edition, Oxford University Press, 2009.

Reference Books:

1. Liu, C. L.: Introduction to Discrete Mathematics. McGraw Hill Education (India) Private Limited (2008)
2. Trembley, Manohar: Discrete Mathematical Structures. McGraw Hill Education (India) Private Limited (2 February 2001).
3. Jiri Matousek, Invitation to Discrete Mathematics, Clarendon Press (23 July 1998)

Discussion

- Basics of Discrete Mathematics.
- Example oriented.

Course No:	*Title of the Paper:*	*Credits*			
MCA 102	Computer Programming and Problem Solving	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Describe the fundamentals of C programming language.
- Demonstrate C coding.
- Explain the skills for problem solving.

Prerequisite:

Basic reasoning ability.

Learning Outcome:

On completion of the course, students will be able to:

- Solve problems through simple C programs.
- Develop advance C program to solve real life problems.
- Analyze the basics of graphics programming.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: C fundamentals **16 L**

C fundamentals, variables, data types, operator & expression, console I/O, Control statements, The C preprocessor

Unit II: Functions, Arrays and Pointer **20 L**

Overview of a function, defining a function, accessing a function, function prototypes, call by value, call by reference, recursion, Storage classes, String functions, other functions (sqrt(), exit(), malloc(), free())

Defining an array, array initialization, processing an array, passing array to a function, multidimensional array, arrays and strings, pointer declarations, passing pointer to a function, pointer and one dimensional arrays, Operation on pointers, pointers and multidimensional arrays, array of pointers, pointers to functions, function returning pointers, Command-line parameters

Unit III: Structures and Unions **12 L**

Structures, Declaration and Initializing Structure, Accessing Structure members, Structure Assignments, Arrays of Structure, Passing Structure to function, Structure Pointer, Unions

Unit IV: File Management **12 L**

Defining and opening a file, closing a file, input/output operations on files, error handling during I/O operations, random access files, command line arguments, programming examples. Dynamic Memory Allocation: Dynamic memory allocation, allocating a block of memory: malloc, allocating multiple blocks of memory: calloc, releasing the used space: Free, altering the size of a block: realloc, programming examples.

Text Books:

1. Kanetkar Y., "*Let Us C*", BPB Publications; 14th edition, 2016
2. Balagurusamy, E. '*Programming in ANSI C*', McGraw Hill Education (India), 6th Edition, 2012
3. Griffiths, D., '*Head First C*", Shroff/O'Reilly,' First edition, 2012.

Reference Books:

1. Kernighan, Brian W., Ritchie, Dennis M., '*The C Programming Language*",' PHI, 2nd edition.
2. Herbert, S., "*C: the Complete Reference"*, McGraw Hill Education; 4th edition.
3. Gottfried, Byron S., '*Theory and Problems of Programming with C*', Tata McGraw Hill Publication

Course No:	*Title of the Paper:*	*Credits*			
MCA 103	Digital Design	L: 3	T: 0	P: 0	Total: 3

Objective:

The course is designed with an objective to

- Represent and manipulate decimal numbers in different coding systems.
- Introduce several levels of digital systems from simple logic circuits to programmable logic devices and hardware description language, analysis and design.

Prerequisites:

Students should be familiar with Number system, Logical design.

Learning Outcome:

On completion of the course, the students will be able to

- Construct logic circuits using logic gates.
- Design both combinational and sequential circuits.
- Identify, formulate and implement problems of digital logic.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Representation of Information: 10 L

Number System: Binary, Octal, Hexadecimal, Positive and Negative Number, 1's and 2's complement, Arithmetic Operations: Addition, Subtraction, etc. Character codes: ASCII and BCD. Error detection and correction, parity codes and Hamming codes.

Unit II: Logic Design 10 L

Logic Gates and their characteristics, Boolean Algebra, Boolean variables and functions- canonical and standard forms, minimization of Boolean functions – Karnaugh Map.

Unit III: Combinational and Sequential Design: 20 L

Implementation of Boolean function and logic gates, concept of combinational design-Adder, Subtractor, Multiplexer, decoders, encoders, simple arithmetic and logic circuits.

Concept of latch, Clock, Study of Flip-Flop- S-R, J-K, D,T. Counters- synchronous and asynchronous, Modes of counter, registers.

Unit IV: Memory and Programmable logic Design 10 L

PLA, PAL, FPGA concept and volatility.

Unit V: Basic CPU Organization : 10 L

Simple functional block diagram of a CPU, instruction execution process, Memory Units**,** Access time and cost considerations: random access, serial access, direct access.

Text Books:

1. Morris M. M., "*Digital Logic and Computer Design*", Pearson ,2004
2. Morris M. M., Cillet M. D."*Digital Design*", Pearson, 5th edition, 2013.

Reference Books:

1. WakerlyJ.F.,"*Digital Design: Principles And Practices*",Pearson,4th Edition,2008

2. SalivahananS,Arivazhagan S., "*Digital Circuits and Design*", VIKAS Publishing House PVT LTD,4th Edition,2012.
3. Hamacher V.C. Vranestic Z.G, Zaky,S.G. "*Computer Organization"*, McGraw-Hill, 5th edition , 2011.

Discussion:

Emphasis should be given to

- Logic circuits.
- Characteristics and functions of different electronics components.
- Simple mentioning of the fundamentals of memory units.

Course No:	*Title of the Paper:*	*Credits*			
MCA 104	Organizational Behaviour	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Describe current research in organizational behavior and identify how can be applied to workplace settings
- Understand how application of OB frameworks, tools, and concepts can enhance individual, group, and organizational effectiveness
- Reflect one's own beliefs, assumptions and behaviors with respect to how individuals, groups and organizations act in order to expand the approaches and increase his / her organizational effectiveness

Learning Outcome:

On completion of the course, students will be able to:

- Describe current research in organizational behavior and identify how can be applied to workplace settings
- Distinguish how application of OB frameworks, tools, and concepts can enhance individual, group, and organizational effectiveness
- Reflect his / her own beliefs, assumptions and behaviors with respect to how individuals, groups and organizations act in order to expand the approaches to increase his / her organizational effectiveness.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Focus and Purpose **5 L**

Definition, need and importance of organizational behaviour – Nature and scope – Frame work – Organizational behaviour models.

Unit II: Individual Behaviour **12 L**

Personality – types – Factors influencing personality – Theories – Learning – Types of learners – The learning process – Learning theories – Organizational behaviour modification.

Misbehaviour – Types – Management Intervention.

Emotions - Emotional Labour – Emotional Intelligence – Theories.

Attitudes – Characteristics – Components – Formation – Measurement- Values.

Perceptions – Importance – Factors influencing perception – Interpersonal perception- Impression Management.

Motivation – importance – Types – Effects on work behavior.

Unit III: Group Behaviour **10 L**

Organization structure – Formation – Groups in organizations – Influence – Group dynamics – Emergence of informal leaders and working norms – Group decision making techniques – Team building - Interpersonal relations – Communication – Control.

Unit IV: Leadership and Power **8 L**

Meaning – Importance – Leadership styles – Theories – Leaders Vs Managers – Sources of power –

Power centers – Power and Politics.

Unit V: Dynamics of Organizational Behaviour **10 L**

Organizational culture and climate – Factors affecting organizational climate – Importance.

Job satisfaction – Determinants – Measurements – Influence on behavior. Organizational change – Importance – Stability Vs Change – Proactive Vs Reaction change – the change process – Resistance to change – Managing change.

Stress – Work Stressors – Prevention and Management of stress – Balancing work and Life.

Organizational development – Characteristics – objectives –. Organizational effectiveness

Text Books:

1. Stephen P. Robins, "*Organisational Behavior*", PHI Learning / Pearson Education, 11th edition, 2008.
2. Fred Luthans, "*Organisational Behavior*", McGraw Hill, 11th Edition, 2001

Reference Books:

1. Schermerhorn, Hunt and Osborn, "*Organisational behavior*", John Wiley, 9th Edition, 2008.
2. Udai Pareek, "*Understanding Organisational Behaviour*", 2nd Edition, Oxford Higher Education, 2004.
3. Mc Shane & Von Glinov, "*Organisational Behaviour*", 4th Edition, Tata Mc Graw Hill, 2007.
4. Hellrigal, Slocum and Woodman, "*Organisational Behavior*", Cengage Learning, 11th Edition 2007.
5. Ivancevich, Konopaske & Maheson, "*Oranisational Behaviour & Management*", 7th edition, Tata McGraw Hill, 2008

Course No:	*Title of the Paper:*	*Credits*			
MCA 105	Accounting and Financial Management	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- To impart basics of formal accounting process.
- To give idea about financial statements and its preparation.
- To give basics of financial management and management accounting.

Prerequisite:

Basic Idea of Accounting and Finance.

Learning Outcome:

On completion of the course, students will be able to:

- Prepare financial statements and able to prepare reports on financial matters.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Recording of Transactions **15 L**

Meaning and definition of accounting, parties or users interested in accounting, branches of accounting. Accounting concepts and conventions. Basic accounting terminologies, Classification of accounts, Journal entry, ledger posting and balancing of ledger. Subsidiary Books- meaning and importance, preparation of cash book.

Unit II: Preparation of financial statements **15 L**

Preparation of Trial Balance: Financial Statements – meaning, objectives, preparation of Trading and Profit and Loss Accounts, Balance Sheet – meaning and objectives and Preparation of Balance Sheet of sole Trading concern and corporate entities. Classification of Assets and Liabilities. Depreciation – meaning, causes, accounting for depreciation. Accounting Software – Tally (introductory part).

Unit III: Conceptual framework of finance **15 L**

Financial Management - meaning and objectives, functions of financial management. Concept of capital structure-computation of cost of capital, concept and consequences of over and under capitalization, Management of Working Capital-need of working capital, operating cycle, sources of working capital.

Unit IV: Management Accounting Tools **15 L**

Budget and Budgetary Control – definition, objectives of budget, classification, advantage, characteristics of budget, Preparation of production/sales and cash budget. Capital Budgeting: meaning, importance and methods of capital budgeting. Concept of Marginal Costing, Cost – Volume- Profit analysis, Break-even Point. Standard costing and variance analysis-material and labour variances

Text Books:

1. B.B.Dam, R.A.Sarda, R.Barman, B.Kalita, '*Theory and Practice of Accountancy (V-I),*'Capital Publishing Company, Guwahati.

2. R.K.Sharma, S.K.Gupta, '*Management Accounting*' Kalyani Publishers, Ludhiana

Reference Books:

1. M.Y. Khan, P.K.Jain, '*Principles of Financial Management*' Tata McGraw Hills, New Delhi.
2. Ravi M. Kishore, '*Cost and Management Accounting*' Taxmann, New Delhi

Discussion:

- Real life approach of Accounting techniques

Course No:	*Title of the Paper:*	*Credits*			
MCA 106	Programming Lab – I	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to

- Demonstrate C coding.
- Explain the skills for problem solving.

Prerequisite:

MCA 102.

Learning Outcome:

On completion of the course, students will be able to:

- Solve problems through simple C programs.
- Develop advance C program to solve real life problems.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Program combining control structure and array.
- Finding the largest/smallest element in an array.
- Basic matrix operations.
- Programs using function, pointer, structure, union and files.

Course No:	*Title of the Paper:*	*Credits*			
MCA 107	Digital Design Lab	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to

- Design various logic circuits using logic gates.

Prerequisite:

MCA 103

Learning Outcome:

On completion of the course, students will be able to:

- Construct logic circuits using logic gates.
- Design both combinational and sequential circuits.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Implementation of different logic circuits using logic gates.
- Experiments on combinational and sequential circuits.

Course No:	*Title of the Paper:*	*Credits*			
MCA 201	Numerical Analysis and Statistical Techniques	L: 3	T: 0	P : 0	Total: 3

Objective:

This course is designed with an objective to

- Discuss different methods of Numerical Analysis.
- Explain different statistical methods and techniques.

Prerequisite:

Basics of calculus, idea about Statistical data, measures of central tendency, combination, permutation sampling

Learning Outcome:

On completion of the course, students will be able to:

- Apply different numerical methods in practical problems.
- Use and apply various statistical techniques in real life problems.
- Write computer programs on different numerical and statistical techniques.
- Create software on different numerical and statistical techniques.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Interpolation **12 L**

Interpolation : Interpolation with equal intervals – Newton's forward and backward interpolation formula, use of operators Δ and E in polynomial interpolation, interpolation with unequal intervals – relation between divided differences and simple differences, Newton's general divided difference formula, and Lagrange's interpolation formula.

Unit II: Numerical Differentiation and Integration **12 L**

Maximum or minimum value of the function using numerical differentiation. General quadrature formula of numerical integration, Trepezoidal rule, Simpsons one –third and three-eight's rule's, Weddle's rule. Numerical Solution of Differential Equations: Euler's method, Picard's method of successive approximation and Runge-Kutta method. Solution of system of Linear equation: Cramer's rule, elimination method by Gauss, Jordan's method, Gauss-Seidel's method. Solution of numerical equation using Newton-Raphson method.

Unit III: Probability theory **12 L**

Basic terminology, different definitions of probability, elementary theorem with illustration, conditional probability – Bayes theorem (without proof) with real life examples, Random variables and their density and distribution functions. Mathematical expectations and its use in decision making (problems), variance and covariance, addition and multiplication theorem of expectation, moments and moment generating functions and their application.

Unit IV: Probability distributions and Test of significance: **12 L**

Binomial, Poisson and Normal distributions and their simple properties (without derivation of the distribution), tests of significance, t-test, F-test (Emphasis should be given on numerical problems).

Unit V: Correlation and Regression Analysis **12 L**

Karl-Pearson's coefficient of correlation, Rank correlation coefficient, Lines of regression, Method of Least squares, Fitting of second degree polynomial using the method of least squares.

Text Books:

1. Rao, G.S.S. B., "*Probability and Statistics for Engineers*", 3rd edition, Scitech Publications, 2006.
2. Das N.G, "Statistical Methods", 4th Edition, Tata McGraw Hill, 2012.

Reference Books:

1. Gupta, S.P. "*Statistical Methods*", 5th edition, Chand & Sons publication, 2012.
2. Gupta, S.C. and V.K. Kapoor, "*Fundamentals of Mathematical Statistics*", 5th edition, S Chand & Sons publication, 2010.

Discussion:

- Real life applications with programming approach

Course No:	*Title of the Paper:*	*Credits*			
MCA 202	Data and File Structures using C++	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Explain linear and non-linear data structures and its applications.
- Demonstrate the sorting and searching techniques and its efficiencies.
- Illustrate various algorithm design techniques.
- Implementing data structure techniques using C++ programs.
- Explain various file structures and their utilities.

Prerequisite:

Basic knowledge of coding.

Learning Outcome:

On completion of the course, students will be able to:

- Apply and analyze the concept of time, space complexity of an algorithm.
- Identify well-known generic data structures such as stack, queue, tree and related algorithms and apply them to solve problems.
- Design data structures and algorithms to solve problems.
- Comprehend the concept of file structures.
- Implement selected data structures and searching/sorting algorithms Using C++ language.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Fundamental Notions: 12 L

Primitive and composite data types, Time and Space Complexity of Algorithms, Concept of Big-O, small-o & Big-Ω.

Unit II: Linear Data Structure: 12 L

Stacks, Queues, Arrays, Linked Lists, Circular & Doubly Linked Lists.

Unit III: Trees 12 L

Introduction to Trees, Properties of Trees, Pedant vertices in a Tree, Center of a Tree, Rooted Binary Trees, Concepts of Trees, Extended Binary Trees, Complete Binary Trees, General Trees, Binary Search Trees, Weight balanced and Height balanced Trees, AVL Tree, Balanced Multi-Way Trees, Threaded Binary Trees.

Unit IV: File Structures: 12 L

Concepts of Fields, Records and Files, Concepts of Blocks, Clusters, Sectors. Sequential File Organization, Variable length Records and Text Files, Indexing Structures like B-trees, ISAM, Hashing Techniques for Direct Files, Inverted lists, Multilists.

Unit V: Sorting and Searching: 12 L

Selection-sort, Insertion-sort, Bubble-sort, Quick-sort, Heap-sort, Merge-sort. Searching Techniques; Binary search, Linear search.

Text Books:

1. Seymour L," Data Structures", Tata McGraw Hill, Reprint, 2012.
2. Baluja G.S., "Data Structure Through C++", Dhanpat Rai Publication, Reprint, 2012

Reference Books:

1. Weiss, "*Data Structures and Algorithm Analysis in C++*", Pearson Education, 2012.
2. Cormen, Leiserson, Rivest, "*Introduction to Algorithms*", Mil Press & McGraw - Hill Publication,2012

Course No:	*Title of the Paper:*	*Credits*			
MCA 203	Computer Organization and Architecture	L: 3	T: 0	P: 0	Total: 3

Objective:

The course is designed with an objective to

- Describe the basic structure and operations of a digital computer.
- Illustrate the different ways of communicating with I/O devices and standard I/O interfaces.
- Indicate the relationship between a computer's instruction set architecture and its assembly language instruction set.

Prerequisites:

Students should be familiar with Number system, Logical design.

Learning Outcome:

On completion of the course, the students will be able to

- Create an assembly language program to program a microprocessor system.
- Develop independent learning skills and be able to illustrate more about different computer architecture and hardware.
- Identify high performance architecture design.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: CPU Architecture: **16 L**

Instruction format - operand addressing formats; Addressing modes - direct, indirect, immediate, relative, indexed. ; Instruction set selection, hardware - software tradeoffs; Instruction execution process - fetch and execution cycles; data path organization – single and two buses; micro programmed and hardwired control microprogramming concept, RISC vs CISC.

Unit II: **8085 Programming:** **10 L**

Introduction to 8085 microprocessor, addressing modes, Instruction sets, Assembly level programming.

Unit III: I/O Architecture: **10 L**

Characteristics of simple I/O devices their controllers; I/O interface,data transfer synchronization - memory - mapped and isolated I/O scheme, Bus arbitration mechanism; Concept of I/O channels and peripheral processors.

Unit IV: Data transfer mode: **10 L**

Modes of data transfer**,**direct memory access 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

Unit V: Memory Concepts: **14 L**

Memory hierarchies - cache memory- Locality of reference, Direct Mapping, Associative Mapping, Block set associative mapping techniques ,Efficiency of cache system ,virtual memory –address space ,address mapping using pages memory page table, page replacement .Associative memory –

CAM ,math logic.

Text Books:

1. Hamacher.V.C.,Vranestic Z.G., Zaky S.G. "*Computer Organization"*, McGraw-Hill,5th Edition,2011.
2. Mano M.M., "*Computer System architecture*", Pearson, 3rd Edition.

Reference Books:

1. Hamachar C., Vranesic Z. , Zaky S., Manjikian N., '*Computer organization & Embedded Systems*', McGraw Hill International Edition , 6th Edition, 2007.
2. Ram, B., "*Fundamentals of Microprocessors and Microcomputers*", 5th edition, DhanpatRai Publications, 2012.

Discussion:

Emphasis should be given to

- Foundations of Microprocessor 8085

Course No:	*Title of the Paper:*	*Credits*			
MCA 204	Object Oriented Programming and Design	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Explain the object oriented approach to problem solving through C++,
- Demonstrate C++ coding,
- Explain a practical productive way to develop software.

Prerequisite:

Knowledge of programming.

Learning Outcome:

On completion of the course, students will be able to:

- Solve problems through simple C++ programs.
- Develop C++ programs to solve real world problems.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Fundamentals of C++ **12 L**

Introduction to object oriented programming, user defined types, polymorphism, and encapsulation. Getting started with C++ - syntax, data-type, variables, strings, functions, exceptions and statements, namespaces and exceptions, operators. Flow control, functions, recursion. Arrays and pointers, structures.

Unit II: Classes, objects and Operator overloading **12 L**

C++ extension to structures, member access operators static members, array of objects, returning objects from functions, Friend functions, pointers to members, friend classes, stack class, Default constructors, overloaded constructors, constructors with default arguments, copy constructors, dynamic constructor, destructor, Defining operator overloading, operator function as member function and friend function, overloading unary and binary operators, type conversions, function overloading

Unit III: Templates and Exception Handling **12 L**

String template, instantiation, template parameters type checking, function template, template argument deduction, specifying template arguments, function template overloading, default template arguments, specialization, conversions. Error handling, grouping of exceptions, catching exceptions, catch all, re-throw, resource management, auto ptr, exceptions and new, resource exhaustion, exceptions in constructors, exception in destructors, uncaught exceptions, standard exceptions.

Unit IV: Inheritance, virtual Functions and Polymorphism **12 L**

Types of inheritance, Defining derived class, Access specifiers, public and private inheritance, accessing base class members, ambiguity in multiple inheritance, virtual base classes, abstract classes, Derived class constructor with arguments, initialization lists in constructors, classes within classes. Virtual functions, pure virtual functions, abstract classes, implementation of virtual functions, this pointer, static and dynamic binding, virtual functions in derived classes, object

slicing, virtual functions and constructors, calling virtual functions from destructors, virtual base classes, Rules for virtual functions.

Unit V: File handling **12 L**

Basics of file handling in C++, classes for stream operations, operation on files, file opening modes, file pointer, error handling during file operations.

Text Books:

1. Kanetkar Y., 'Let Us C++', BPB Publications; 14th edition, 2016
2. Balagurusamy, E. 'Object Oriented Programming with C++', McGraw Hill Education, 6th Edition, 2013
3. Thareja R.,'Object Oriented Programming with C++', Oxford University Press, 2015.

Reference Books:

1. Herbert, S., 'C++: the Complete Reference', 4th edition, McGraw Hill Education.
2. Lafore R., 'Object Oriented Programming in C++' ,4th Edition, Pearson India
3. Stroutstrup B., "The C++ Programming Language", Pearson Education Publication

Course No:	*Title of the Paper:*	*Credits*			
MCA 205	Quantitative Graph Theory: Mathematical foundations	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Explain the overview of graph and its application in problem solving.
- Discuss different application of graph in real world.

Prerequisite:

Basic knowledge of graph and its properties**.**

Learning Outcome:

On completion of the course, students will be able to:

- Formulate related problems in the language of graphs
- Write computer programs and apply it in different problems.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Introduction **15 L**

Incidence and degree; Handshaking Lemma; Isomorphism; Sub-graphs and Union of graphs; Connectedness; Walks, Paths and Circuits; Components, Eulerian graph, Eulerian necessary and sufficient conditions; Bipartite graph, isomorphic graphs, isomorphism.

Unit II: Planner Graph **10 L**

Combinatorial and geometric dual, Kuratowski's graph, detection of planarity, Thickness and Crossings, cut-sets and cut-vertices

Unit III: Matrix representations of graph **10 L**

Incidence; Adjacency, circuit, path matrices their properties and applications.

Unit IV: Coloring Techniques **10 L**

Chromatic number ; Chromatic polynomial ; The six and five color theorems ; vertex coloring and upper bounds and its applications , structure of k- chromatic graph

Unit V: Theoretical algorithms **10 L**

Topological sort, minimum spanning trees, DFS, BFS, shortest paths, maximum flow, Ford-Fulkerson method, Applications in biology and social sciences.

Text Books:

1. Deo N., "Graph Theory with Applications to Engineering and Computer Science" PHI learning, New Edition, 2014.
2. Robin J. W., "Introduction to Graph Theory", Prentice Hall publication,5th edition, 2010.

Reference Books:

1. Douglas B. W., “Introduction to Graph Theory”, Prentice Hall India Learning Private Limited, 2nd edition, 2015.
2. Harary F., “Graph Theory", Narosa publishing house, 2013.

Discussion:

Emphasis should be given to the following topics

- Theoretical algorithms and its applications.

Course No:	*Title of the Paper:*	*Credits*			
MCA 206	Programming Lab – II A	L: 0	T: 0	P: 3	Total: 3

Objective:

This course is designed with an objective to

- Implementing data structure techniques using C++ programs.
- Explain the object oriented approach to problem solving through C++,
- Demonstrate C++ coding.
- Apply different graph approach in practical problems.

Prerequisite:

MCA 202, MCA 204, MCA 205

Learning Outcome:

On completion of the course, students will be able to:

- Design data structures and algorithms to solve problems
- Solve problems through simple C++ programs.
- Implement selected data structures and searching/sorting algorithms Using C++ language.
- Develop C++ programs to solve real world problems.
- Formulate related problems in the language of graphs
- Write computer programs and apply it in different problems.

Total Marks: 150

(In Semester Evaluation – 60 & End Semester Evaluation – 90)

Part A

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

C++ Programs covering:

- Stack, Queue and Linked List operations
- Tree operations
- Implementation of Searching and Sorting techniques.

Part B

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

- concepts of classes and objects, constructors and destructors
- use of memory management
- inheritance
- virtual functions
- operator overloading and dynamic binding using polymorphism
- exception handling and use of templates
- File handling in C++

Part C

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Implementation of basic graph properties ,coloring techniques, planner graph
- Implementation of theoretical algorithms in biological and social science.

Course No:	*Title of the Paper:*	*Credits*			
MCA 207	Programming Lab – II B	L: 0	T: 0	P: 2	Total: 2

Objective:

This course is designed with an objective to

- Practice different optimization methods in practical problems.
- Write computer programs on optimization methods.
- Develop assembly language program.

Prerequisite:

MCA 201, MCA 203

Learning Outcome:

On completion of the course, students will be able to:

- Apply different optimization methods in practical problems.
- Use and apply various queuing models in real life problems.
- Write computer programs on optimization methods.
- Create an assembly language program to program a microprocessor system.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Part A

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Solution of Optimization Problem by Programming language like C.
- Case Study.

Part B

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

Write Assembly language programming of 8085

- Using arithmetic and logical instructions
- Memory related operations using looping techniques

Course No:	*Title of the Paper:*	*Audit Course*
MCA 208	Oral and Written Communication	

Objective:

This course is designed with an objective to

- Develop skills in writing, digital presentation, and oral communication as complementary parts of communication and literacy.
- Develop and refine their own voice and sense of style.
- Practice and refine different forms of communication that are appropriate for the multiple contexts and disciplines that they engage with.
- Realize thoroughly the relationship between form and content.

Learning Outcome:

On completion of the course, students will be able to:

- Apply skills in writing, digital presentation, and oral communication as complementary parts of communication and literacy.
- Refine their own voice and sense of style.
- Apply different forms of communication that are appropriate for the multiple contexts and disciplines that they engage with.
- Relate the relationship between form and content.
- Use the role of drafting, revising, presenting, and receiving, processing, and using feedback as important parts of the writing process.

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

Unit I: Language and Communication:

Definition of Communication; Function and purpose of Communication; Process of Communication; Barriers of Effective Communication; Types of communication, Verbal communication, on-verbal communication; The Impact of Communication on Performance, Advantages and disadvantages of oral communication; Improving oral communication; One-to-One oral communication; Oral Presentations

Unit II: Listening Skills:

What is listening; Types of Listening; Barriers of Effective Listening; Strategies for Effective Listening; Semantic Markers; Listening to Complaints.

Unit III: Reading and Writing Skills:

Introduction, Definition and Meaning of Reading, Purpose of Reading, Types of Reading, SQ3R Technique of Reading, Note Taking; Paraphrasing; Elements of writing; Business Letter Writing; Other Business Communications

Unit IV: Organizational Documents:

Introduction; Business Letter Writing, Types of Business Letter, Job application, Other Business Communication. Memo; Circulars and Notices.

Course No:	*Title of the Paper:*	*Credits*			
MCA 301	Formal Language and Automata	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Identify different formal language classes and their relationships
- Design grammars and recognizers for different formal languages

Prerequisite:

MCA 101, MCA 102

Learning Outcome:

On completion of the course, students will be able to:

- Design automata, regular expressions and context-free grammars accepting or generating a certain language.
- Transform between equivalent deterministic and non-deterministic finite automata, and regular expressions.
- Simplify automata and context-free grammars.
- Determine if a certain word belongs to a language.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introductory Concept Topic **5 L**

Alphabets, Languages, Grammars.

Unit II : Finite Automata (Deterministic and Nondeterministic) **10 L**

Equivalence of DFA's and NDFA's, conversion, automata with ε - transition, Moore and Mealy machines, properties of regular sets, minimization of finite automata

Unit III: Regular Grammar **15 L**

Regular expressions, regular languages, regular expression and equivalence to FA, Algebraic laws for regular expressions Pumping Lemma and applications push down automata and context free languages, properties of context free languages.

Unit IV: Context Free Language **10 L**

context-free grammars and languages , parsing (or derivation) and parse trees, ambiguity of grammar and language, pushdown automaton (PDA), equivalence between CFG and PDA , normal form of CFG

Unit V: Context Sensitive Language **5 L**

Context sensitive languages, linear bound automata

Unit V: Turing Machines **15 L**

Turing hypothesis, Turning compatibility, Turing machines as a transducer, recognizer and acceptors, Variations of tuning machines – non-deterministic, multiple tape, two-way infinite tape,

multidimensional, multihead. Universal turning machines, recursively enumerable languages, Undecidable problems.

Text Books:

1. Linz P., "An Introduction to Formal Language and Automata", Jones and Bartlett Publishers, Inc., USA, 2011.
2. MishraK. L. P., "Theory of Computer Science: Automata, Languages and Computation" PHI, 3rd Edition, 2009.

Reference Books:

1. Nagpal C. K, "Formal Languages And Automata Theory" ,OXFORD UNIVERSITY PRESS, 2011
2. Hopcroft, John E.; Motwani, Rajeev; Ullman, Jeffrey D, "Introduction to Automata Theory, Language and Computation", Addison –WEISLEY, 3rd edition, 2013.

Discussion

- Finite Automata
- Regular Language and Expression
- Context free Grammar, Push Down Automata (PDA) and Turing Machines

Course No:	*Title of the Paper:*	*Credits*			
MCA 302	Database Management System	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Illustrate the basic database concepts, including the structure andoperation of the relational data model.
- Construct simple and moderately advanced database queries usingStructured Query Language (SQL).
- Illustrate logical database designprinciples, including E-R diagrams and database normalization.

Prerequisite:

Students should be familiar with Data Structure.

Learning Outcome:

On completion of the course, students will be able to:

- Create a database using a DBMS package.
- Construct queries using SQL.
- Normalize a database.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introduction to DBMS & ER Models **12 L**

Concept DBMS, Advantage of using DBMS, Data Models (object based logical models, record based logical models), DBMS users, Overall System Structure.

ER diagrams, generalization, specialization, aggregation. Database models - Network model, Hierarchical model, and Relational model.

Unit II: Relational Model **12 L**

Underlying concepts, Structure, Study of Relational Languages (relational algebra, relational calculus, SQL), Storage and File Structure, File Organization.

Unit III: Indexing and Relational Database Design **12 L**

Primary and Secondary, B+ Tree Indexed Files, B - Tree Indexed Files, Static and Dynamic Hashing, Multiple Key Access, Grid File, Partitioned Hashing.

Integrity constraints (domain constraints, referential, assertions, triggers, functional dependencies), Normalization (using FDs, multivalued dependencies, join dependencies), Domain-key normal form.

Unit IV: Transactions and Concurrency Control **12 L**

Concepts, State, ACID properties, Serializability and Recoverability, Testing for Serializability. Lock - based Protocols, Timestamp Based Protocols, Validation Based Protocols, Multiversion Schemes, and Deadlock Handling.

Unit V: Recovery System **12 L**

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

Text Books:

1. Silberschatz A, Korth H.F., Sudersan S., '*Principles of Database Systems*', McGrawHill Publication, 5th Edition, 2006.
2. Elmarsi R.,NavatheS.B.,'*Fundamentals of Database Systems*', Narosa publishing Company, 4th edition,2007.

Reference Books:

1. UllmanJ.D .,WidomJ., 'A First Course in Database Systems",3rd Edition, Pearson,2014.
2. Bayross I., 'Database Concepts and Systems', Shroff Publications, 3rd Edition,2011

Discussion:

- Emphasis to SQL, ER Model, Normalization, transactions.

Course No:	*Title of the Paper:*	*Credits*			
MCA 303	Object Oriented Programming using Java	L: 3	T: 0	P: 0	Total: 3

Objective:

The course is designed with an objective to

- Explain Object-Oriented programming concepts and techniques.
- Demonstrate core level Java Programs, debugging and testing.
- Show implementation of Object-Oriented concept using Java Programs.
- Explain System modelling techniques using UML
- Illustrate the Use cases, Class diagram and Sequence and Activity diagrams.
- Create the Object Oriented design of a system from the requirements model using UML class, object, and sequence diagrams.

Prerequisites:

Basic knowledge of software development and coding.

Learning Outcome:

On completion of the course, the students will be able to

- Resolve programming problems using object oriented principles.
- Apply Java programming syntax, control structures and Java programming concepts.
- Develop Java Applications.
- Identify Java standard libraries and classes.
- Write, compile, execute and troubleshoot Java programming.
- Utilize Java Graphical User Interface in the program writing.
- Analyze and design a Java Program to solve real world problems based on object-oriented principles.
- Apply the principles and practice of object oriented modelling and design in the construction of robust and maintainable programs.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Encapsulation and Data Abstraction: **12 L**

Class, Objects, Methods, Constructors, Memory Allocation, Garbage Collection, Packages and Interfaces, Access Specifiers.

Unit II: Polymorphism and Inheritance **12 L**

Overloading, Overriding, Dynamic Method Dispatch.
Single, Multilevel, Hierarchical, Extending a class, implementing an Interface.

Unit III: Exception Handling and Multithreading **12 L**

Exception types, try, catch and finally blocks, custom exception, throw and throws.
Creating threads, Join() and Sleep() methods, Synchronization, wait() and notify() methods.

Unit IV: The Java Library: **12 L**

String handling, Collection framework, Input/ Output

Unit V: Object Oriented Modelling as a Design Technique: **12 L**

Introduction to UML, Overview, History, Usage, Diagrams.

Objects, Classes, Class Diagrams, Values and Attributes, Operation and Methods, Links and Associations, Multiplicity, Generalization and Inheritance, Aggregation.

Events, States, Transitions and Conditions, State Diagrams.

Use Case Models, Use Case Diagrams, Sequence Models, Scenarios, Sequence Diagram, Activity Models, Activity Diagram

Text Books:

1. Blaha M.R.,Rumbaugh J, "*Object Oriented Modeling and Design with UML*", Pearson Education, 2nd Edition, Reprint-2015.
2. MalhotraS,Choudhary S, "*Programming in Java*", Oxford University Press, 2nd Edition,2015.

Reference Books:

1. Bruce E, "*Thinking in Java"*, Pearson Publication.
2. Jaime N, Frederick A. H, "*Introduction to Programming and Object-Oriented Design Using Java*", Wiley Publication.

Course No:	*Title of the Paper:*	*Credits*			
MCA 304	Operating Systems	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Explain the concepts and internal working of various operating systems.
- Illustrate the concepts of processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files
- Demonstrate working of different operating system.

Prerequisite:

Knowledge of Computer Organization.

Learning Outcome:

On completion of the course, students will be able to:

- Analyze the concepts, structure and design of operating Systems.
- Explain operating system design and its impact on application system design and performance.
- Demonstrate competence in recognizing and using operating system features.
- Work on different OS environment.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introduction **12 L**

Batch processing, multiprogramming, time-sharing, distributed system, Functions, components and structure of an operating system.

Unit II: Process Management **12 L**

Support for concurrent processes - Shared data, Critical sections, Mutual exclusion, Mutual exclusion, busy form of waiting, lock and unlock primitives, semaphore, Synchronization, block and wakeup, Inter process communication, message passing mechanism, Multithreading Models, Threading issues, Pthreads, Process states, interrupt mechanisms, scheduling algorithms, implementation of concurrency Primitives. System deadlock - Prevention, detection and avoidance.

Unit III: Memory Management **12 L**

Contiguous and non - contiguous memory allocation; Swapping Virtual memory paging and Segmentation -page replacement and space allocation policies.

Unit IV: Input/Output and File Systems **12 L**

I/O Management I / O Software goals and structure, Device drivers, Terminal handling, Block and character devices. System Structure, File management strategies, tradeoffs, Directory structures, File system protection, Security, Integrity, Device independence.

Unit V: Distributed Operating System **12 L**

Concepts of Distributed Operating System - UNIX / LINUX

Text Books:

1. Stallings W., "Operating systems" 2nd edition, Prentice Hall, 1995.
2. Silberschatz A., Galvin P.B, "Operating System Concepts" 5th edition, Addison-Wesley Publishing Company, 1998.
3. Deitel H.M., "Operating System" 2nd edition, Addison-Wesley Publishing Company 1990.

Reference Books:

1. Tanenbaum A.S., "*Modern Operating Systems",* 2nd edition, Prentice Hall of India, New Delhi, 2002.
2. Chandra P., Bhatt P., "*An Introduction to Operating Systems Concept"*, Prentice Hall of India.

Course No:	*Title of the Paper:*	*Credits*			
MCA 305	Software Engineering	L: 3	T: 0	P: 0	Total: 3

Objective:

The course is designed with an objective to

- Illustrate software process models such as the waterfall and evolutionary models.
- Discuss the role of project management including planning, scheduling, risk management, etc.
- Test software using testing approaches such as unit testing and integration testing.

Prerequisites:

MCA 302, MCA 303

Learning Outcome:

On completion of the course, students will be able to

- Design software system using SDLC models.
- Create the SRS document.
- Write programs using appropriate rules.
- Test software using testing approaches such as unit testing and integration testing.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Software Engineering & Software Project Management **12 L**

Software development and life cycle, project size and its categories.

Planning of a software project; project - control and project team standards; Scheduling, Risk management, Configuration management. Software cost estimation and evaluation techniques.

Unit II: Software requirements & Software Design **12 L**

Different methodologies and techniques of Software requirement analysis. Various design concepts and notations; Modern design techniques; high level design and detailed design; Structured design, object -oriented design.

Unit III: Coding, Verification, Validation and Testing **12 L**

Standards and guidelines for coding, coding walkthrough, code inspection.

Documentation and implementation procedures, Performance of software systems; software metrics and models; Documentation of project systems, manuals and implementation.

Structural Testing, Unit Testing of a test suite etc.

Unit IV: Software Reliability: **12 L**

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.

Unit V: Software Maintenance: **12 L**

Categories of maintenance; Problems during maintenance; solution to maintenance problems, Maintenance process, Maintenance models, Reverse Engineering, Software Re-Engineering, Estimation of Maintenance costs

Text Books:

1. Mall R., '*Fundamentals of Software Engineering*', Prentice-Hall of India, 4th edition, 2014.
2. JaloteP., '*An Integrated Approach to Software Engineering*', Narosa Publishing House, 3rd edition, 2014..

Reference Books:

1. Pressman R.S., '*Software Engineering: A Practitioner's Approach*', McGraw Hill Publication, 8th edition, 2014.
2. James K.L., "*Software Engineering*", PHI Learning, 2nd Edition.

Course No:	*Title of the Paper:*	*Credits*			
MCA 306	Programming Lab – III A	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to:

- Demonstrate core level Java Programs, debugging and testing.
- Show implementation of Object-Oriented concept using Java Programs.

Prerequisite:

MCA 102, MCA 303.

Learning Outcome:

On completion of the course, students will be able to:

- Apply Java programming syntax, control structures and Java programming concepts.
- Develop Java Applications.
- Write, compile, execute and troubleshoot Java programming.
- Utilize Java Graphical User Interface in the program writing.
- Analyze and design a Java Program to solve real world problems based on object-oriented principles.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

Java Programs covering:

- Encapsulation and Data Abstraction
- Polymorphism and Inheritance
- Exception Handling and Multithreading
- The Java Library

Course No:	*Title of the Paper:*	*Credits*			
MCA 307	Programming Lab – III B	L: 0	T: 0	P: 2	Total: 2

Objective:

This course is designed with an objective to

- Explain the concepts and internal working of various operating systems.
- Illustrate the concepts of processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files
- Demonstrate working of different operating system.
- Construct simple and moderately advanced database queries using Structured Query Language (SQL).

Prerequisites:

MCA 203, MCA 302

Learning Outcome:

On completion of the course, students will be able to:

- Demonstrate competence in recognizing and using operating system features.
- Work on different OS environment.
- Create a database using a DBMS package.
- Construct queries using SQL.
- Normalize a database.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

PART – A

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

- Linux
- File systems
- Shell programming

PART – B

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

- Create a database from a given ER Diagram.
- Perform some query using SQL.

Course No:	*Title of the Paper:*	*Audit Course*
MCA 308	Introduction to Data Science	

Objective:

This course is designed with an objective to

- Develop practical Data analysis skills
- Develop fundamental knowledge of concepts underlying data science projects.
- Develop practical skills in modern analytics
- Give hands on experience with real world data analysis

Prerequisite:

Good mathematical background and programming skills and basic knowledge of statistics.

Learning Outcome:

On completion of the course, students should have following competences:

- Ability to reflect developed methods of activity i.e. mathematical models.
- Ability to propose a model to invest and test methods and tools of professional activity.
- Capability to solve real world data analytics problems.
- Capability of developing new research methods to solve data analytics problems.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introduction to Data Science

Basic concepts of data, types of data, data collecting methods, problem solving in Data Science, Data Science components, Introduction to R.

Unit II: Exploratory Data analysis

Analytics problem solving, Exploratory Data analysis**,** Inferential Statistics, data visualization in R.

Unit III: Linear Regression

Basics of Correlation, Scattered diagram, Simple linear regression, Multiple linear regression.

Unit IV: Classification and Clustering

kNN, Decision tree, SVM.

Unit V: ensemble method

Random forest

Unit VI: Introduction to probability

Basics of probability, Conditional probability, Bayes theorem, Naïve bayes and logistic regression.

Unit VII: Practical implementation using R

Books Recommended:

1. Saltz, J, S., Stanton, J, M., "An Introduction to Data Science", SAGE Publications, 2018.
2. James, G., Witten, D., Hastie, T., Tibshirani, R., "An Introduction to Statistical Learning with Applications in R", Springer, 2013.
3. Wickham, H., Grolemund, G., "R for Data Science", O'REILLY publications, 2017.

Course No:	*Title of the Paper:*	*Credits*			
MCA 401	Artificial Intelligence	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Introduce the basic techniques of artificial intelligence: problem solving, heuristic search, knowledge representation, logic system and inference
- Provide insight into the artificial intelligence, neural networks and applications.
- Introduce students about this critically important technology to increase their understanding of its implications, to pique their curiosity about the remarkable developments that are taking place and help to familiarize students with many faces of Artificial Intelligence and Neural Networks.

Prerequisite:

Basics of linear algebra, data structures and algorithms, and probability, proficiency in programming language.

Learning Outcome:

At the end of the course, students will be able to:

- Survey and design some practical artificial intelligence applications in any information system domain.
- Solve some natural problems in a systematic way to provide effective and optimal solutions.
- Identify core ideas, techniques, and applications that characterize the emerging fields of Artificial Intelligence.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introduction to Artificial Intelligence **5 L**

Natural and Artificial Intelligence, Definitions of AI, Nature of AI Solutions, Testing Intelligence , AI Techniques, Testing Intelligence (Turing Test, Chinese Room Test), Data Pyramid, Computer Based Information Systems in the Pyramid, AI Applications Areas (Mundane Tasks, formal Tasks and Expert Tasks)

Unit II: Problem Solving, Search and Heuristic Search Techniques **15 L**

Problems and Problem Spaces, Problem Characteristics, Production Systems, Control Strategies (Forward Chaining, Backward Chaining), Exhaustive Searches and Blind Methods (Depth First Search, Breadth First Search)

Heuristic Search Techniques, Generate and Test, Hill Climbing, Branch and Bound technique, Best First Search and A* Algorithm, Problem Reduction, AND / OR graphs, AO* Algorithm, Constraint Satisfaction Problems, Means Ends Analysis

Unit III: Knowledge Representation and Knowledge Acquisition **12 L**

Knowledge Representation (KR): Formal KR (First Order Predicate Logic), Procedural KR (Rule, Semantic Nets ,Frames, Conceptual Dependency, Scripts, and Semantic Web), KR Issues and Limitations

Using Predicate logic: Syntax and Semantics for FOPL, Properties of Wff's, Conversion to clausal form, Horn's clauses, Unification, Resolution Principles, Deduction Rules

Knowledge Based Systems (KBS) Architecture, Knowledge Acquisition (KA): Techniques, Role of Knowledge Engineer (KE), Knowledge Sharing and Dealing with Multiple Experts, KA Issues and Limitations

Unit IV: Probabilistic Reasoning and Uncertainties 8 L

Crisp and Fuzzy Logic, Fuzzy Membership Functions, Fuzzy Rule Based Systems, Probability and Bayes' Theorem, Certainty factors, Dempster-Shafer theory, Non Monotonic Reasoning and Truth Monitoring Systems

Unit V: Artificial Neural Networks and Expert Systems 20 L

Introduction to Neural Computing and Artificial Neural Network (ANN), Fundamental Concepts: Biological Neuron, Artificial Neuron, Activation Function and Output Functions, Introduction to ANN Architectures, Applications of ANN and Expert Systems.

Neural Network Architectures: Hopfield Model, Parallel Relaxation; Perceptron, Lineraly Separable Problems, and Fixed Increment Perceptron; Learning: Multi-layer Perceptron, Non-Lineraly Separable Problems, and Back Propagation Learning; Self Organizing Networks: Kohonens Networks; Recurrent Networks.

Objectives of Learning, Hebb's Rule, Delta Rule, Supervised Learning, Unsupervised Learning

Text Books:

1. Rich E., Knight K., Nair S.B., "*Artificial Intelligence*", Tata McGraw Hill Education, 3rd Edition, 2008.
2. Patterson D.W., "*Introduction to Artificial Intelligence and Expert Systems*", Prentice Hall of India, 1990.
3. Russell S., Norvig P., "*Artificial Intelligence: A Modern Approach*", Pearson Education, 3rd Edition, 2015.
4. Sivanandam S. N., Deepa S. N., "*Principles of Soft Computing*", Wiley India, 2nd Edition 2011

Reference Books:

1. Nilsson N.J., "*Principles of Artificial Intelligence*", Narosa Publishing House, New Delhi, Reprint 2002.
2. Jackson P., "*Introduction to Expert Systems*", Addison Wesley Publishing Company, 1998

Discussion:

Real life applications with programming approach.

Course No:	*Title of the Paper:*	*Credits*			
MCA 402	Optimization Techniques and Queuing Theory	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Discuss different optimization techniques.
- Explain different queuing models.

Prerequisite:

Probability, Stochastic Processes and Markov Chain; Mathematical background of computer science, computer programming; Mathematical background of Vector Space.

Learning Outcome:

On completion of the course, students will be able to:

- Apply different optimization methods in practical problems.
- Use and apply various queuing models in real life problems.
- Write computer programs on optimization methods.
- Create own software on optimization techniques.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Basics of Linear Programming **12 L**

Introduction to Operations Research and OR models ,Introduction to and Formulation of Linear programming problem (LPP), Assumptions of LPP, Feasible solution, Degenerate and Non-degenerate solution, Convex sets and properties.

Unit II: Methods for solving Linear Programming **12 L**

Graphical method of solution of LPP, simplex method, revised simplex method, Primal and Dual problem, sensitivity analysis.

Unit III: Transportation and Assignment Problems **12 L**

North-West Corner Method, Least cost Method, Vogel's Method, Modi Method, Hungarian Methods etc.

Unit IV: Integer and Dynamic Programming **12 L**

Idea of Integer and Dynamic Programming, Introduction and Method of solution; Gomory's method for All-integer programming problem and its algorithm, Branch and Bound method. Dynamic programming approach to solving LPP

Unit V: Queuing Models **12 L**

Essential features of a queuing system; Performance measures of a queuing system – transient and steady-state; Role of Poisson and Exponential distribution in Queue --- Distributions of arrivals, of inter arrivals times, of departures and of service times, and their applications in specific queuing models, classification of queuing models. Single server queue models --- {(M/M/1) : (∞ /FCFS)}, {(M/M/1) : (N/FCFS)} (Sans Derivations) and their applications Multi-server queuing models (birth & death processes)

Text Books:

1. Lieberman F.J., "*Introduction to Operations Research*", 9th edition, McGraw hill education, 2012.
2. Verma A.P., "*Introduction to Operations Research*", 4th edition, SKK and Sons-New Delhi, 2010.

Reference Books:

1. Srinath L.S., "*Linear Programming*", 4th edition, East-West, New Delhi, 2010.
2. Gillett, B.G., "*Introduction to Operation Research – a computer oriented algorithmic approach*", 5th edition,McGraw-Hill, 2011.

Discussion:

Real life applications with programming approach

- Model Formulation
- Case study on Simplex and Graphical Method.
- Advantages of Vogel's and MODI method
- Case study on Queuing models

Course No:	*Title of the Paper:*	*Credits*			
MCA 403	Data Communication and Computer Network	L: 3	T: 1	P: 0	Total:4

Objective:

This course is designed with an objective to

- Introduce Data Communications and Computer Networks.

Prerequisite: Nil

Learning Outcome:

On completion of the course, students will be able to:

- Analyze the Layers 1-3 of ISO/OSI reference model.
- Specify and identify deficiencies in existing protocols and formulate new and better protocols.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: **12 L**

Overview: Objectives and Applications of Computer Communication, Network and Protocol Architecture, ISO-OSI reference model, TCP/IP Protocol, Layer-wise functionality.

Unit II: **12 L**

Physical Layer: data transmission methods, modulation and multiplexing methods, communication media, standard protocols : RS-232C, RS-449, X.21

Unit III: **12 L**

Data link layer: Medium Assess Control in broadcast networks, FDDI, satellite networks. Framing, error control techniques, data link protocols, SDLC protocol.

Unit IV: **12 L**

Network layer: Routing, Congestion, Internetworking issues and devices, IP, X.25 protocols, ATM Network.

Unit V: **12 L**

Presentation formatting issues and methods, Data Compression techniques, Cryptography principles, IPV and IPV6 security

Text Books:

1. Tenanbaum,A.S, "Computer Networks", Pearson Education Asia, 4th edition, 2011.
2. Forouzan, B.A. "Data Communication and Networking "Tata McGraw Hill, 6th edition,2014.

Reference Books:

1. Trivedi,B," Data Communication and Networks ",Oxford University Press, 1st Edition, 2016
2. Stallings, W,"Data and computer communications", Pearson education Asia,7th Edition,2011.

Discussion:

- Hands on practice with the available lab devices.

Course No:	*Title of the Paper:*	*Credits*			
MCA 414	Parallel and Distributed Computing	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Illustrate pipelining in parallel processing.
- Illustrate instruction and arithmetic pipeline techniques.

Prerequisite:

MCA 203, MCA 304.

Learning Outcome:

On completion of the course, students will be able to:

- Differentiate between parallel processing in uniprocessor and multiprocessor.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Parallel Processing & Parallel Computer Structures **12 L**

Parallel Processing mechanism, Parallelism in uniprocessor systems. Architecture classification scheme.

Unit II: Pipeline and Vector Processing: **12 L**

Instruction and arithmetic pipelines, Vector Processing requirements, Pipeline computers and vectorization methods.

Unit III: vector processors & SIMD Array Processors **12 L**

STAR 100, CRAY - 1, CYBER - 205, Fujitsu 200 and their special features. Parallel algorithms for array processors; SIMD computers and performance enhancement.

Unit IV: Multiprocessor Architectures and Programming: **12 L**

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.

Unit V: Data Flow Computers: **12 L**

Data - driven computing and languages; Advantage and potential difficulties, etc.

Text Books:

1. Hwang K., Briggs F. A., "*Computer Architecture and Parallel Processing*", McGraw Hill publication, 1st edition, 1984.
2. Hwang K., Jotwani N., "*Advanced Computer Architecture (Parallelism, Scalability, Programmability)*", McGraw Hill Education (India) Private Limited, 2nd edition, 2000.

Reference Books:

1. Govindarajalu B., "*Introduction Computer Architecture and Organization: Design Principles and Applications*", McGraw Hill Education (India) Private Limited, 2nd edition, 2010

Discussion:

Emphasis should be given to the following topics

- Instruction pipeline and arithmetic pipeline.
- Flynn's Classifications.
- Systollic Array.

Course No:	*Title of the Paper:*	*Credits*			
MCA 424	Embedded System	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Describe fundamental embedded systems design paradigms, architectures, possibilities and challenges, both with respect to software and hardware.
- Design simple embedded systems.
- Illustrate the architecture and functions of microcontrollers and microprocessors.

Prerequisites:

Students must have studied Microprocessor and Computer Organization as a subject in the previous semesters.

Learning Outcome:

After completing this course the students will be able to

- Explain the microprocessor, microcontroller and state their differences.
- Describe basic functions, structure and applications of Embedded Systems.
- Write programs for microprocessor and microcontroller based system.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I:Introduction to Embedded Systems: 10 L

Overview of Embedded systems, Features, Requirements and application of embedded systems, recent trends in the Embedded system design. Concept on deferent controllers like 8051, PIC etc.

Unit II: Architecture of 8051/PIC: 12 L

Basic differences of Microcontroller and microprocessor – Microcontroller and embedded processor. Intel family 8 bit microcontrollers, Architecture of 8051, Pin configuration and description, ports, program counter & PSW, Interrupts, RAM allocation, Switching in Register Banks.

Unit III: Embedded Software: 10 L

Hardware and software in Embedded system – memory organizations, device driver – interrupt handling unit, concept of embedded software engineering – RTOS (Real Time Operating System), Popular RTOS and their applications, Basics of serial communication

Unit IV: Programming Concept in Embedded design: 14 L,

Assembly language programming, Instruction format of 8051, data types, addressing modes, registers of 8051.

Unit V: Embedded application development 14 L

Interfacing and communication links: Bus organization of 8051, 8255 & its operating modes, dynamic RAM interfacing, LCD interfacing, real time clock

Text Books:

1. Mazidi M.A., Mazidi .J.D., McKinlay.R.D., "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson , 2nd edition,2011.
2. Kamal.R., "Embedded systems: architecture, programming and design", Tata McGraw Hill Publications, 2nd edition, 2013.

Reference Books:

1. Tammy Noergaard, "Embedded *Systems Architecture"* Newnes, 2nd edition, 2012.
2. Ram.B. , *"Fundamentals of Microprocessors and Microcomputers*", 5th edition, DhanpatRai Publications, 2012.
3. Furber.S.," *Arm System-on-chip architecture*", Pearson, Second Edition, 2013.

Discussion:

Emphasis should be given to

- Embedded System
- Architecture and programming of 8085microprocessor and 8051microcontroller.

Course No:	*Title of the Paper:*	*Credits*			
MCA 434	Microprocessor Based System	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- List and specify the various features of microprocessor, memory and I/O devices including concepts of system bus.
- Identify the various elements of 8085 microprocessor architecture, its bus organization including control signals.
- Illustrate the concepts of memory and I/O interfacing with 8085 processor with Programmable devices
- List and describe the features of advance microprocessors.

Prerequisite:

MCA 103, MCA 203.

Learning Outcome:

On completion of the course, students will be able to:

- Design assembly language program
- Design modern digital system including computer systems with microprocessor as central device connected to memory and I/O devices
- Describe RISC based processors.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introduction to Microprocessor : 10 L

Introduction, Components : Registers, ALU ,control and timing, System bus (data, address and control bus) , Microprocessor Architecture and Operations, Memory, I/O devices, Memory and I/O operations

Unit 2: 8085 Microprocessor : 10 L

Architecture, Pin Functions ,Bus system, Demultiplexing of Buses, Instruction Cycle, Machine Cycles, T-States, Memory Interfacing

Unit III: Assembly Language Programming: 12 L

Classification of Instructions, Addressing Modes, 8085 Instruction Set, Writing, Assembling , Executing ,Debugging Programs , Writing programs with decision making, looping using data transfer, arithmetic, logical and branch instructions, Stack & Subroutines, Developing Counters and Time Delay Routines, Code Conversion, BCD, Arithmetic and 16-Bit Data operations

Unit IV: Interfacing Concepts: 8 L

Interrupts In 8085, Programmable Interrupt Controller 8259A, Programmable Peripheral Interface 8255A

Unit V: Advanced Microprocessors : 12 L

8086 logical block diagram and segments, 80286: Architecture, Registers, Memory access in GDT

and LDT, multitasking, addressing modes, flag register 80386: Architecture, Register organization, 80486 : The technical features ,Pentium : Architecture and its versions

Unit VI: **8 L**

ARM Processor: Architecture features, Logical block diagram of ARM7 architecture

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", Penram International Publication (India) Pvt. Ltd. 6th Edition,2013
2. Douglas Hall, Microprocessor & Interfacing - McGraw Hill Education; 3rd edition July 2017
3. Barry B. Brey, "The Intel Microprocessors, 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium, PentiumPro Processor, PentiumII, PentiumIII, Pentium IV, Architecture, Programming & Interfacing", Eighth Edition, Pearson Prentice Hall, 2009.

Reference Books:

1. N. Senthil Kumar, M. Saravanan, S. Jeevanathan, S. K. Shah Microprocessors and Interfacing, , Oxford 2012
2. Daniel Tabak Advanced Microprocessors, McGraw Hill Education; 2 edition November 2011
3. Douglas Hall, Microprocessor & Interfacing - McGraw Hill Education; 3rd edition July 2017
4. Savaliya M. T., 8086 Programming and Advance Processor Architecture, Wiley India Pvt.Ltd 1st 2012
5. Triebel & Singh, The 8088 and 8086 Microprocessors, Pearson Education 3rd Edition 2000

Discussion:

- Emphasis should be given to programming concept of microprocessor

Course No:	*Title of the Paper:*	*Credits*			
MCA 415	Advanced DBMS	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Introduce various other advanced topics, including query optimization, concurrency, data warehouses, object-oriented extensions

Prerequisites:

MCA 302

Learning Outcomes:

On completion of this course the student will be able to:

- Evaluate and Apply Advanced Database Development Techniques.
- Design & Implement Advanced Database Systems.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Query Processing and Security **12 L**

Study of algorithms for selection operations, sorting, join operations, projection, set operations, aggregation; measurement of cost, evaluation of expressions, transformation of relational expressions, optimization techniques.

Violations, authorization, views, privileges, granting privileges, security specification in SQL.

Unit II: Parallel Databases **12 L**

Introductory concepts, partitioning techniques, interoperation parallelism - parallel sort (range partitioning sort, parallel external sort-merge), parallel join (partitioned join, fragment-and-replicate join, parallel hash join), interoperation parallelism (pipelined, independent).

Unit III: Distributed Databases **12 L**

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), multidatabase systems.

Unit IV: Object Oriented Databases **12 L**

Object classes, inheritance, DAG representation, object identity and persistence (brief introduction to ODMG C++), storage structure for object oriented databases.

Unit V: Introductory concepts **12 L**

Data mining and data warehousing, multimedia databases, distributed information systems, information retrieval systems, spatial and graphical databases, transactions processing monitors, transactional workflows, active and main memory databases. Cloud Computing, Real time database, Web Database, Temporal Database.

(Example and case studies from ORACLE to be discuss in the course)

Text Books:

1. Silberschats, K. and Sudershan, '*Principles of Database Systems'*, McGraw Hill Publication, 2011.
2. Raghuramakrishnan R and Gehrke J, '*Database Management System'*, McGraw-Hill, Inc, 3rd edition, 2014

Reference Books:

1. Elmarsi R.,NavatheS.B.,'*Fundamentals of Database Systems*', Norsa publishing Company,7th edition ,2015.
2. Prabhu C.S.R., '*Object Oriented Database System: Approaches and Architecture*'; Prentice Hall, 3rd edition, 2010

Discussion:

- Query Optimization
- Object oriented Database
- Security

Course No:	*Title of the Paper:*	*Credits*			
MCA 425	System Software	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Introduce the major concept areas of language translation and compiler design.
- Provide insight into the various phases of compiler and its use, code optimization techniques, machine code generation, and use of symbol table.
- Introduce the basic concept of parser (LL parser and LR parser).
- Provide practical programming skills necessary for constructing a compiler.

Prerequisites:

MCA 202, MCA 301

Learning Outcome:

After completing this course the students will be able to

- Explain the relationship between system software and machine architecture, design and implementation of assemblers, linkers and loaders.
- Describe the design, function and implementation of assemblers, linkers and loaders.
- Define macro processors and system software tools.
- Describe the design of a compiler and the phases of program translation from source code to executable code and the files produced by these phases.
- Explain lexical analysis phase and its underlying formal models such as finite state automata, push-down automata and their connection to language definition through regular expressions and grammars

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Assembler **8 L**

Overview of the Assembly process, Design of Assembler: Two Pass Assembler & Single Pass Assembler, Symbol table

Unit II: Macros and Linkers & Loaders **12 L**

Introduction to Macros, Various types of Macros, Design of Macro Processor: Single Pass & Double Pass.

Introduction to Linkers & Loaders, Functions of a loader, Types of Loaders, Databases used in Loaders, Design of Loaders - Absolute & DLL, Static and dynamic Linking, debugger

Unit III: Basics of Compiler **6 L**

A Simple Compiler, Difference between Interpreter, Assembler and Compiler, Types of Compiler, Analysis - Synthesis Model of compilation, The Phases of a Compiler, The Grouping of Phases, and Compiler - Construction Tools.

Unit IV: Lexical Analyzer and Parser **18 L**

The Role of the Lexical Analyzer, Input Buffering, Specification of Tokens, Recognition of Tokens, A Language for Specifying Lexical Analyzers, Design of a Lexical Analyzer Generator.

Need and role of the parser, Context Free Grammars, Top Down parsing, General strategies, Recursive Descent Parser, Operator-Precedence Parsing, Predictive Parser, LL(1) Parser, Shift Reduce Parser, LR Parser, LR (0) item, Construction of SLR Parsing table, Introduction to LALR Parser, Error handling and recovery in syntax analyzer, YACC, Design of a syntax analyzer for a sample language.

Unit V: Syntax - Directed Translation and Code Optimization 16 L

Syntax - Directed Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S - Attributed Definitions, L - Attributed Definitions, Top Down Translation, Analysis of Syntax - Directed Definitions, Type Systems, Specification of a Simple Type Checker, Equivalence of Type Expressions, Type Conversions.

Principal sources of Optimization, DAG, Optimization of basic blocks, Global data flow analysis, Efficient data flow algorithms, Source language issues, Storage organization, Symbol tables, Dynamic storage allocation, Issues in design of a code generator, A simple code generator algorithm.

Text Books:

1. Pal S., "*Systems Programming*", Oxford University Press, 2011.
2. Aho A.V., Shethi R., Ulman; "*Compilers - Principles, Techniques and Tools*", 2nd Edition, Pearson Education, 2002.
3. Dhamdhere D. M.,"*Systems Programming and Operating Systems*", Tata McGraw Hill Company, 2nd Edition, 2009.

Reference Books:

1. Donovan J. J., "*Systems Programming*", Tata McGraw Hill Company, 2nd Edition, 2000.
2. Raghavan V., "*Principles of Compiler Design*", Tata McGraw Hill Education Publishers, 2010.

Discussion:

- Real life applications with programming approach

Course No:	*Title of the Paper:*	*Credits*			
MCA 435	Data Mining and Warehousing	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Determine the overall architecture of a data warehouse and techniques and methods for data gathering and data pre-processing using OLAP tools.
- Discuss different data mining models and techniques.

Prerequisites:

MCA 302.

Learning Outcome:

On completion of the course, students will be able to:

- Compare various data mining techniques, methods in integrating and interpreting different data sets
- Obtain improved mechanism for effective and efficient data analysis
- Discuss the role of data warehousing and enterprise intelligence in industry and government

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Data Warehousing **10 L**

Concept of data warehousing its evolution. Scope of data warehouse type of data and their use, metadata & their types.

Unit II: Data warehouse architecture **10 L**

System process, process flow within a data warehouse, extract and load process, backup and achieve process, query management process. Process architecture, load manager, warehouse manager, warehouse manager architecture, query manager architecture. Data warehouse schema. Fact data, Dimension data, Partitioning data, data marting.

Unit III: Multidimensional Data model, Data cube, OLAP operations **10 L**

Database schemas – star, star flake, snowflake schemas, and multidimensional schemes, partitioning strategy, Aggregation, Data marting, Metadata system and Data warehouse process managers.
Hardware and operational Design: Hardware architecture, physical layout security backup recovery, Capacity planning, Tuning & Testing data warehouse.

Unit IV: Data Mining **15 L**

Concept of data mining- learning- data warehouse and data mining. KDD and Data Mining. The knowledge Discovery processes its different stages. Data Mining Techniques – Verification model, Discovery model.

Unit V: Data Mining Algorithms **15 L**

Fundamental concept of Association rule, Classification rule, Learning, Neural networks, Genetic algorithm, Rough set techniques. Support vector mechanism, Web mining, Text mining, Sequence mining, Spatial Data mining, Issues and challenges in Data mining, Data mining application

areas(example with practical case studies).
Features of some DM algorithm Priori, Partition, and Border algorithm (Association rules)
Types of clustering algorithm with features of Kmedoid & K mean algorithm, CLARA, CLARANS, DBSCAN

Text Books:

1. Han J.,Kamber M., "*Data Mining: Concepts and Techniques*", Morgan Kaufmann, India,3rd edition, 2011,.
2. Pujari A K, "*Data Mining Techniques*", University Press, India,3rd edition, 2013

Reference Books:

1. Han M, and Smyth, "*Principles of Data Mining*", PHI, India, 2nd edition, 2011.
2. Duffy, Dean G, "*Advanced Engineering Mathematics with MATLAB*", CRC Press, 2013

Discussion:

- OLAP techniques
- Clustering and Classification
- Association Rule Mining

Course No:	*Title of the Paper:*	*Credits*			
MCA 406	Lab – IV A	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to

- Explain different optimization methods in practical problems.

Prerequisite:

MCA 402

Learning Outcome:

On completion of the course, students will be able to:

- Write computer programs on optimization methods.
- Create own software on optimization techniques.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Solution of Optimization Problem by Programming language like C.
- Case Study.

Course No:	*Title of the Paper:*	*Credits*			
MCA 4247	Lab – IV B (ES)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objectives to

- Design simple embedded systems.

Prerequisite:

MCA 424

Learning Outcome:

After completing this course the students will be able to

- Develop simple embedded systems.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Write assembly language programs of 8085 using arithmetic and logical instructions, loop and jump techniques, subroutines.
- Study on different interfacing techniques using 8051 microcontroller.

Course No:	*Title of the Paper:*	*Credits*			
MCA 4347	Lab – IV B (Microprocessor Based System)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objectives to

- Illustrate the architecture and functions of microcontrollers and microprocessors.

Prerequisite:

MCA 434

Learning Outcome:

After completing this course the students will be able to

- Write programs for microprocessor and microcontroller based system

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

Develop ALP

- Using all the instructions
- Using different addressing modes
- Memory related operations using looping techniques.
- Using subroutine

Course No:	*Title of the Paper:*	*Credits*			
MCA 4157	Lab IV B (ADBMS)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objectives to

- Apply Advanced Database Development Techniques

Prerequisites:

MCA 415

Learning Outcome:

After completing this course the students will be able to

- Design & Implement Advanced Database Systems.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Database security
- Views
- User Creation
- Concurrency control.
- Grant and Revoke
- Distributed Transactions

Course No:	*Title of the Paper:*	*Credits*			
MCA 4257	Lab IV B (SS)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objectives to

- Provide practical programming skills necessary for constructing a compiler.

Prerequisites:

MCA 425

Learning Outcome:

After completing this course the students will be able to

- Design compiler.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

List of Experiments:

- C program for implementing different parsing algorithms.
- Various programs using LEX.
- Various applications of YACC programs.

Course No:	*Title of the Paper:*	*Credits*			
MCA 4357	Lab IV B (DMW)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objectives to

- Discuss different data mining models and techniques.

Prerequisites:

MCA 435

Learning Outcome:

After completing this course the students will be able to

- Obtain improved mechanism for effective and efficient data analysis

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Different Clustering and Classification Algorithms
- Dendogram Representation
- Different Proximity measures
- Validity Indices

Course No:	*Title of the Paper:*	*Audit Course*
MCA 408	Minor Project and Project Writing	

Objective:

This course is designed with an objectives to

- Describe LaTeX programming.
- Create real time minor project.

Learning Outcome:

After completing this course the students will be able to

- Write Project report in LaTeX.
- Typesetting technical documents.
- Standalone real time minor project development.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

Unit I:

Installation of the software LaTeX

Unit II:

Understanding Latex compilation, Basic Syntex, Writing equations, Matrix, Tables

Unit III:

Page Layout – Titles, Abstract Chapters, Sections, Referrences, Equation references, citation. List making environments, Table of contents, Generating new commands, Figure handling numbering, List of figures, List of tables, Generating index.

Unit IV:

Packages: Geometry, Hyperref, amsmath, amssymb, algorithms, algorithmic graphic, color, tilez listing.

Unit V:

Classes: article, book, report, beamer, slides. IEEtran.

Unit VI:

Applications to: Writing Resumae, Writing question paper, Writing articles/ research papers, Presentation using beamer.

Unit VII:

Theory, Practical and exercises based on the above concepts

Unit VIII:

Minor project development and documentation.

Course No:	*Title of the Paper:*	*Credits*			
MCA 501	Design and Analysis of Algorithms	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Explain the concepts of algorithms.
- Create strong logic and problem solving approach.
- Design a better algorithm before programming.

Prerequisite:

Basic concepts of Algorithm and programming.

Learning Outcome:

On completion of the course, students will be able to:

- Analyze the efficiency of the algorithms,
- Design and analyze algorithms before its implementation

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Introduction to algorithms **12 L**

Order notations, mathematical induction, recurrence relations

Unit II: Algorithm design techniques **20 L**

Greedy algorithms, divide-and-conquer algorithms, dynamic programming, optimization problems, Amortized Analysis.

Unit III: NP-completeness **12 L**

Classes P and NP, reduction, NP-completeness, examples of NP-complete problems

Unit IV: Approximation algorithms **8 L**

Introduction to Approximation algorithms, TSP, PTAS and FPTAS

Unit V: Randomized algorithms **8 L**

Introduction to Randomized algorithms, Monte Carlo and Las Vegas algorithms

Text Books:

1. Charles E. L., Thomas H. C., Ronald L. R., Clifford S., "Introduction to Algorithms", 3rd Edition, PHI Learning Pvt. Ltd., 2009
2. Sridhar S., "Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2015.
3. Mohan, Chandra I., "Design and Analysis of Algorithms", PHI Learning Pvt. Ltd, 2nd edition, 2010

Reference Books:

1. Aho, A. V., Hopcroft J.E.,Ullman, J. D., '*The Design and Analysis of Computer Algorithms*,' Addision Wesly.
2. Richard, J, "*Algorithms*", 1st Edition, Pearson Education, 1994

Course No:	*Title of the Paper:*	*Credits*			
MCA 502	Web Designing	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Discuss about various concepts related to internet and web.
- Explain about different web based technologies.

Prerequisite:

Basic ideas of internet and web, Hypertext, computer networks, HTML etc.

Learning Outcome:

On completion of the course, students will be able to:

- Write HTML, CSS and scripting languages.
- Use and apply various web programming languages.
- Create websites.
- Handle and maintain web based projects.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Internet Basics. **12 L**

Network Connectivity Types- dial up- PPP, SLIP; leased, VSAT, ISP, HTTP,TCP/IP, IP Address, Domain Names, DNS, Services-email, WWW,URL,ARP,RARP,WWW, Search Engine, Concept of Client –Server computing, Thin Client vs. Flat Client, Middle ware, Client Pull, Server Push.

Unit II: Web Client **12 L**

Web Architecture, Browsers, Basic features & Functions, Static, dynamic, Active pages Client-side Inclusive- Scripts, VB Scripts, Java Scripts, Activex, ASP, Plugins, Case Study- IE, Firefox

Unit III: File Server, Mail Server, Web Server **12 L**

FTP, Telnet, SMTP, MIME etc. Web Server : Stateful vs. Stateless Servers, Web Server Architecture, Basic features & Functions, URL, Server side inclusive – CGI, API, PERL,JSP,PHP,ASP.NET, Web database Connectivity- JDBC, ODBC, Case Study- IIS, Apache-Tomcat.

Unit IV: Web Application Development **12 L**

HTML,XML, DHTML with DTD concept <head> & <body> section, able, form, Frame, hyperlinks, CSS Web Page Design using HTML authoring tools- FrontPage/ Dream weaver, Visual Web Developer

Unit V: Web Security **12 L**

Firewalls, Tunnels, SSI, X-HTTP, IPV & IPV6 security, Digital Signature.

Text Books:

1. Roy U.K., "Web Technologies", Oxford Higher Education, 9th edition 2015.
2. Godbole A., "Web Technologies", Tata McGraw Hill, 4th edition 2012.

Reference Books:

1. Bates C., "*Web Programming*", Willey India Ltd, 3rd edition 2012.
2. Jackson C., "*Web Technologies-A computer science perspective*", Pearson India, 4th edition 2010

Discussion:

- Java Script, CSS, AJAX
- PHP,JSP and ASP.net
- Visual Web Development tools.
- Web based Project.

Course No:	*Title of the Paper:*	*Credits*			
MCA 503	Computer Graphics and Multimedia	L: 3	T: 0	P: 0	Total: 3

Objective:

This course is designed with an objective to

- Discuss different graphics packages, demonstrate functionality of display devices.
- Explain all aspects of computer graphics including hardware, software and applications.
- Explain how an animation is created.
- Write program functions in C to implement different graphics primitives.

Prerequisite:

Basic knowledge of graphics, display devices and "C"

Learning outcomes:

On completion of this course students will able to:

- Develop graphical algorithm to design different graphical pattern
- Design simple graphical pattern using C
- Resolve programming problem using graphics packages.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I:Display Devices **20 L**

Different display devices, Video Controller, Digital frame buffer , Plasma panel displays, Liquid Crystal Display(LCD), Color-display techniques (Shadow mask and penetration CRT, ,Line Drawing Algorithm, Circle drawing Algorithm

Unit II: Display Description and Interactive Graphics **10 L**

Different Screen co-ordinates, Graphical function, The view algorithms; Clipping Algorithm, Two - dimensional transformation, Pointing and positioning devices

Unit III: **3 -D Graphics** **10 L**

Wire-frame perspective display, Parallel Projection, Perspective depth, Projective transformations, Surface Rendering, Bezier Curves and its properties, B-Splines Curves, Constructive solids – geometry methods, Hidden line and surface elimination, Transparent solids Shadowing Color Models

Unit IV: Concept of Image Processing **10 L**

Techniques and Applications, Definition of image ,filtering, image processing, Geometric transformation of images

Unit V: Multimedia **10 L**

Introduction to multimedia, Multimedia applications, Basics of Animation, Music and sounds, Audio basic Concepts, Digital and Analog basic concepts. MIDI concept, different File format(image, audio, video), Image Compression, Sound Compression, Video Compression

Text Books:

1. *HearnD. ,Baker M.P. , "Computer Graphics", PHI, 2nd edition 2011.*
2. Bhattacharya S, "*Computer Graphics*", Oxford higher education,1st edition 2015.

Reference Books:

1. Pakhira K, "Computer Graphics Multimedia & Animation" 2nd edition, Phi Learning Pvt. ltd
2. Mukherjee D.P., "Fundamentals of Computer Graphics and Multimedia" Phi Learning, 1st Edition.

Discussion:

- Algorithms implementation using C

Course No:	*Title of the Paper:*	*Credits*			
MCA 514	Fuzzy Sets and Applications	L: 3	T: 1	P: 0	Total: 4

Objective:

This course is designed with an objective to

- Recognize the basic knowledge of fuzzy sets and fuzzy logic.
- Gain knowledge in fuzzy relations.
- Be familiar with the concept of fuzzy numbers and arithmetic operations.

Prerequisite:

MCA 101.

Learning Outcome:

On completion of the course, students will be able to:

- Illustrate basic fuzzy system modeling methods and knowledge of fuzzy information processing.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation-60)

Unit I: Fuzzy Set **10 L**

Basic definition, level sets, convex fuzzy sets, basic operations on fuzzy sets, types of fuzzy sets.

Unit II: Extension principle and application **10 L**

Zadeh extention principle, image and inverse image of fuzzy sets, fuzzy numbers, elements of fuzzy arithmetic.

Unit III: Fuzzy Relations **10 L**

Fuzzy relations on fuzzy sets, composition of fuzzy relations, min-max composition and its properties, fuzzy equivalence relation, fuzzy graph.

Unit IV: Fuzzy Logic **10 L**

Fuzzy logic, Fuzzy propositions, fuzzy quantifiers, linguistic variable, inference from conditional fuzzy propositions, compositional rule of inference, applications.

Unit V: Fuzzy Control **10 L**

Introduction to fuzzy controllers, fuzzy rule base, fuzzy inference engine, fuzzification, defuzzification and various defuzzification methods, fuzzy nueral network, autometa and dynamical systems.

Unit VI: Decision making in fuzzy environment **10 L**

Individual decision making, multiperson decision making, multicriteria decision making, multistage decision making, fuzzy ranking methods, fuzzy linear programming, applications.

Text Books:

1. Klir, G.J. and Yuan, B. "*Fuzzy Sets and Fuzzy Logic: Theory and Applications*", Prentice Hall of India, New Delhi,1997.
2. Zimmermann, H. J., "*Fuzzy set theory and its Applications*", Allied publishers Ltd., New Delhi, 1991.

Reference Books:

1. Dubois, D. and Prade, H. "*Fuzzy sets and systems: theory and applications*", Academic Press, New York, 1980
2. Kandel, A. "*Fuzzy mathematical techniques with applications*", Addison-Wesley, Reading, Mass, 1986
3. Kaufmann, A. and Gupta, M. M. "*Introduction to fuzzy arithmetic: theory and applications*", Van Nostrand Reinhold, New York, 1985.
4. Kosko, B. "*Fuzzy Thinking: the new science of fuzzy logic*", Flamingo, 1994.

Discussion

- Practical application oriented.

Course No:	*Title of the Paper:*	*Credits*			
MCA 524	Machine Learning	L : 3	T : 1	P : 0	Total: 4

Objective:

This course is designed with an objective to

- Explain the concept of Machine Learning
- How to apply Machine Learning concepts to different problems.

Learning Outcome:

On completion of the course, students will be able to:

- Identify the basic theory underlying Machine Learning
- Formulate machine learning problems corresponding to different applications.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Introduction to Machine Learning **5 L**

Machine intelligence and applications, Techniques, Algorithms.

Unit II: Introduction to Fuzzy sets and Crisp sets **10 L**

Fuzzy sets: Basic Types, concepts, Fuzzy sets Vs Crisp Sets, properties of alpha cuts, presentation of Fuzzy sets.

Unit III: operations on Fuzzy Sets **10 L**

Fuzzy complements, Fuzzy Union, Fuzzy Intersections, Crisp and Fuzzy relation, binary Fuzzy Relation, Binary relation on single set, Equivalence Relations, Fuzzy compatibility Relation.

Unit IV: Introduction to ANN **15 L**

Biological Neuron and Artificial neuron Model, McCulloch –Pits Neuron model, Perceptron Classification, Linearly separability, XOR problem, Overview of Neural Network, Architecture, Learning Rules, Supervised learning, unsupervised Learning, Perceptron Learning, reinforcement Learning, delta learning Rule.

Unit V: Multilayer Feed forward **10 L**

Generalized delta learning, back propagation training algorithm and derivation of weight, variant in back propagation.

Unit VI: Fuzzy System and Neuro Fuzzy System and Applications **10 L**

Fuzzy neurons, Fuzzy Neural Network, Fuzzy associative memory, Feature extraction, Application in Pattern Recognition.

Text Books:

1. E. Alpaydin, "Introduction *to Machine Learning*", Prentice Hall of India, 2006.
2. Laurance Fausett, "*Fundamentals of Neutral Networks*", Pearson Education, 2004.

Reference Books:

1. George J. Kir , Bo Yuan," Fuzzy sets and Fuzzy Logic Theory and Application"
2. Timothy J. Ross, "Fuzzy logic with engineering Applications", McGraw Hill, 1997.

Course No:	*Title of the Paper:*	*Credits*			
MCA 534	Pattern Classification	L : 3	T : 1	P : 0	Total: 4

Objective:

This course is designed with an objective to

- Explain the concept of Pattern Classification.
- Explain different algorithms and techniques in Pattern recognition.

Learning Outcome:

On completion of the course, students will be able to:

- Understand the basic concepts in pattern classification
- Apply Pattern Recognition techniques in different problems.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Introduction **10 L**

Introduction, Definitions, data sets for pattern recognition, paradigms, representations of patterns and classes.

Unit II: classification **15 L**

Bayes decision rule, error probability, normal distribution, linear discriminant function, Non-Linear decision boundaries, KNN classifier, Fisher's LDA, Single layer Perceptron, Multi-Layer perceptron.

Unit III: Clusternig **15 L**

Basics of clustering, similarity dissimilarity measures, clusterning criteria, distance functions, K-means algorithm, single linkage and complete linkage algorithm, K-medoids, DBSCAN, Unique clusterning, No existence of clusters.

Unit IV: Feature selection and Extraction **10 L**

Branch and Bound algorithm, sequential forward/ backward selection algorithm, probabilistic separability based criterion function, interclass distance based criterion functions, PCA.

Unit V: Recent advances in Pattern Recognition **10 L**

Structural PR, SVMs, FCM, soft-Computing and Neuro-Fuzzy techniques

Text Books:

1. R.O. Duda, P.E. Hart and D.G. Stork," Pattern Classification", John Wiley,2001
2. Devi V.S., Murty.M.N, "Pattren Recognition:An Introduction", Universities Press,2011

Reference Books:

1. C.M. Bishop," Pattren Recognition and Machine Learning", Springer, 2006

Course No:	*Title of the Paper:*	*Credits*			
MCA 544	Cloud Computing	L : 3	T : 1	P : 0	Total: 4

Objective:

This course is designed with an objective to

- To introduce the broad perceptive of cloud architecture and model
- To understand the concept of Virtualization.
- To be familiar with the lead players in cloud.
- To understand the features of cloud simulator
- To apply different cloud programming model as per need.
- To be able to set up a private cloud.
- To understand the design of cloud Services.
- To learn to design the trusted cloud Computing system

Learning Outcome:

On completion of the course, students will be able to:

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept.
- Choose the appropriate cloud player.
- Choose the appropriate Programming Models and approach.
- Address the core issues of cloud computing such as security, privacy and interoperability
- Design Cloud Services
- Set a private cloud

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Cloud Architecture And Model **12 L**

Technologies for Network-Based System – System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture. Cloud Models: - Characteristics – Cloud Services – Cloud models (IaaS, PaaS, SaaS) – Public vs Private Cloud –Cloud Solutions - Cloud ecosystem – Service management – Computing on demand.

Unit II: Virtualization **12 L**

Basics of Virtualization - Types of Virtualization - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices - Virtual Clusters and Resource management – Virtualization for Data-center Automation.

Unit III: Cloud Infrastructure **12 L**

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources.

Unit IV : Programming Model **12 L**

Parallel and Distributed Programming Paradigms – MapReduce , Twister and Iterative MapReduce – Hadoop Library from Apache – Mapping Applications - Programming Support - Google App Engine,
Amazon AWS - Cloud Software Environments -Eucalyptus, Open Nebula, OpenStack, Aneka, CloudSim

Unit V : Security In The Cloud **12 L**

Security Overview – Cloud Security Challenges and Risks – Software-as-a-Service Security – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Data Security – Application Security – Virtual Machine Security - Identity Management and Access Control – Autonomic Security.

Text Books:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010.

Reference Books:

1. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", TMH, 2009.
2. Kumar Saurabh, " Cloud Computing – insights into New-Era Infrastructure", Wiley India,2011

Course No:	*Title of the Paper:*	*Credits*			
MCA 554	GIS & Remote Sensing	L : 3	T : 1	P : 0	Total: 4

Objective:

This course is designed with an objective to

- To understand the concept of GIS.
- To understand the concept of remote sensing.
- To understand the concept of GIS data analysis.

Learning Outcome:

On completion of the course, students will be able to:

- Explain the concepts and fundamentals of GIS
- Explain the concepts and fundamentals of remote sensing.
- Describe the process of data acquisition of satellite images and their characteristics.
- Acquire and analyze GIS data.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Introduction to GIS **8 L**

GIS - definitions, concept and history of developments in the field of information systems, Computer fundamentals for GIS, Hardware and software requirements for GIS, Coordinate System and Projections in GIS – Conic, cylindrical and planner

Unit II: GIS Data Structure **8 L**

Data structure and formats, Spatial data model, Data inputting in GIS, Data base design - editing and topology creation in GIS, Linkage between spatial and non-spatial data.

Unit III: Data analysis and modeling in GIS **18 L**

Data analysis and modeling in GIS, types of GIS modeling, Decision support systems, Overview of image processing & GIS Packages.

Recent Trends in GIS : AM/FM, Virtual 3D GIS, OLAP, Internet GIS, Open GIS

Unit IV: Introduction of Remote Sensing **8 L**

Electro Magnetic Spectrum, Physics of Remote Sensing, Effects of Atmosphere, Scattering, Different types of Absorption, Atmospheric window, Energy interaction with surface features of Spectral reflectance of vegetation, soil ,and water, atmospheric influence on spectral response patterns, multi concept in Remote sensing.

Unit V: Data Acquisition **8 L**

Types of Platforms, Types and characteristics of different platforms, Photographic products, B/W, colour, colour IR film and their characteristics – resolving power of lens and film- Opto mechanical electro optical sensors

Unit VI: Data Analysis **10 L**

Resolution, signal to noise ratio, data products and their characteristics, visual and digital interpretation, Basic principles of data processing, Radiometric correction, Image enhancement,

Image classification.

Text Books:

1. Paul Curran P.J. Principles of Remote Sensing, ELBS; 1995.
2. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, VI edition of John Wiley & Sons-2000.
3. Anji Reddy, M. 2004: Geoinformatics for environmental management.B.S. Publications
4. Chang.T.K. 2002: Geographic Information Systems. Tata McGrawHill

Reference Books:

1. Charles Elachi and Jakob J. van Zyl , Introduction To The Physics and Techniques of Remote Sensing , Wiley Series in Remote Sensing and Image Processing, 2006.
2. Ram Mohan Rao. 2002: Geographical Information Systems. Rawat Publication.

Course No:	*Title of the Paper:*	*Credits*			
MCA 515	Internet Security	L : 3	T : 0	P : 0	Total: 3

Objective:

This course is designed with an objective to

- Discuss and explain different online security tools to the students.

Learning Outcome:

On completion of the course, students will be able to:

- Describe the general architecture of internet.
- Explain different security tools.

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Introduction and Overview **10L**

Internet Architecture, working procedure of internet (high-level overview), IP Address

Unit II: TCP/IP Protocols, Vulnerabilities, Attacks, and Countermeasures **20L**

Physical Layer: jamming attacks, Data Link Layer: ARP protocol and ARP cache poisoning, Network Layer: IP protocols, packet sniffering, IP Spoofing, IP fragmentation attacks, Network Layer: ICMP protocol and ICMP misbehaviors, Network Layer: IP Routing protocols and Attacks, Transport Layer: TCP protocol, TCP session hijacking, reset and SYN flooding attacks, DoS and DDoS attacks, DNS protocol and attacks, BGP protocol and Attacks

Unit III: Cryptography Basics and Applications **20L**

Secret-Key Encryption, DES, AES, One-way Hash Functions, MD5, SHA-1, and SHA-2, Collision attacks, Block chains and Bit-coins, Diffie-Hellman Key Exchange, Public-Key Encryption, RSA, Digital Signatures, Public-Key Infrastructure (PKI), Case Studies: common mistakes

Unit IV: Network Security Mechanisms **10L**

IP Tunneling and SSH Tunneling, Virtual Private Networks, Firewalls, Bypassing firewalls, Transport Layer Security (TLS/SSL), TLS Programming

Text Books:

1. W. Du, Computer Security: A Hands-on Approach, Create Space Independent Publishing Platform; 1 edition, 2017.
2. A.M. Perry, Online Safety: Scams, SPAM, Viruses and Clouds, Amazon Asia-Pacific Holdings Private Limited, 2017.

Reference Books:

1. M.R.T. Pistorious, The Quick Guide to Cloud Computing and Cyber Security, Amazon Asia-Pacific Holdings Private Limited, 2017.

Course No:	*Title of the Paper:*	*Credits*			
MCA 525	Internet of Things	L : 3	T : 0	P : 0	Total: 3

Objective:

This course is designed with an objective to

- Discuss about Internet of Things
- Discuss different ideas regarding IOT

Learning Outcome:

On completion of the course, students will be able to:

- Discuss about Internet of Things
- Discuss different ideas regarding IOT

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: **10L**

Introduction and Overview: Introduction to IoT, Sensing, Actuation, Basics of Networking : Communication Protocols, Sensor Networks:

Unit II: **20L**

Machine-to-Machine Communications, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino, Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry

Unit III: **15L**

Introduction to SDN, SDN for IoT, Data Handling and Analytics, Cloud Computing, Sensor-Cloud

Unit IV: **15L**

Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT

Text Books:

1. S. Greengard, The Internet of Things, The MIT Press; 1st edition, 2015
2. A. McEwen, Designing the Internet of Things, Wiley; 1st edition, 2013

Reference Books:

1. N. Balani, Enterprise IoT: A Definitive Handbook, Navveen Balani; 4 edition 2015.

Course No:	*Title of the Paper:*	*Credits*			
MCA 535	Network and System Administration	L : 3	T : 0	P : 0	Total: 3

Objective:

This course is designed with an objective to

- Explain the concept of network and system administration,
- Elaborate initial installation of OS to day-to-day administrative,
- Explain management of user accounts and disk space, and the troubleshooting skills.

Prerequisite:

MCA 403.

Learning Outcome:

On completion of the course, students will be able to:

- Manage users, files, software. Install and configure networking services for intranet and Internet domains (Networking)
- Administer network security policies in Linux and Windows environments (Security)
- Evaluate alternative policies and mechanisms for providing reliability features of computer system services and operations (Backups)

Total Marks: 100

(In Semester Evaluation –40 & End Semester Evaluation –60)

Unit I: Networking Overview

Networking history, Protocol Standards, Reference Model (OSI, TCP/IP), Windows and Linux Networking Basics, Switching and Routing basics, Server Administration Basics, Server and Client Installation, Boot Process and Startup Services: Xinetd / Inetd, Managing accounts: users, groups and other privileges, File Systems and Quota Management, Job Scheduling with cron, crontab, anacron and system log analysis, Process controlling and management, Online Server upgrade / update process, Administering Database Server (MySQL)

Unit II: Network Configuration Basics **4L**

IPv4 and IPv6 addressing, Network Interface Configuration, Diagnosing Network startup issues, Linux and Windows Firewall configuration, Network troubleshooting commands

Unit III: Dynamic Host Configuration Protocol (DHCP) **4L**

DHCP Principle, DHCP Server Configuration, DHCP Options, Scope, Reservation and Relaying DHCP Troubleshooting

Unit IV: Name Server and Configuration **6L**

DNS principles and Operations, Basic Name Server and Client Configuration, Caching Only name server, Primary and Slave Name Server, DNS Zone Transfers, DNS Dynamic Updates, DNS Delegation, DNS Server Security, Troubleshooting

Unit V: Web and Proxy Server Configuration **6L**

HTTP Server Configuration Basics, Virtual Hosting, HTTP Caching, Proxy Caching Server Configuration, Proxy ACL, Proxy-Authentication Mechanisms, Troubleshooting

Text Books:

1. The Practice of System and Network Administration, Second Edition Thomas A. Limoncelli, Christina J. Hogan , Strata R. Chalup
2. Advanced Linux Networking, Roderick W. Smith, Addison-Wesley Professional (Pearson Education), 2002.

Reference Books:

1. Linux Network Administrator's Guide, Tony Bautts, Terry Dawson, Gregor N. Purdy, O'Reilly, Third Edition, 2005

Course No:	*Title of the Paper:*	*Credits*			
MCA 506	Lab – V A	L: 0	T: 0	P: 2	Total: 2

Objective:

This course is designed with an objective to

- Explain about different web based technologies.
- Discuss different graphics packages, demonstrate functionality of display devices.
- Explain all aspects of computer graphics including hardware, software and applications.
- Explain how an animation is created.
- Write program functions in C to implement different graphics primitives.

Prerequisite:

MCA 502, MCA 503

Learning Outcome:

On completion of the course, students will be able to:

- Write HTML, CSS and scripting languages.
- Use and apply various web programming languages.
- Create websites.
- Handle and maintain web based projects.
- Develop graphical algorithm to design different graphical pattern
- Design simple graphical pattern using C
- Resolve programming problem using graphics packages.

Total Marks: 100

(In Semester Evaluation – 40 & End Semester Evaluation – 60)

PART-A

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

- Web page designing in simple HTML, CSS, AJAX.
- Scripting languages like JavaScript, ASP, and PHP.

PART-B

Total Marks: 50

(In Semester Evaluation – 20 & End Semester Evaluation – 30)

- Implement of the line ,circle drawing algorithm using "C"
- Implement of polygon and ellipse algorithms using "C"
- Implementation of clipping algorithm
- Image processing using MATLAB.

Course No:	*Title of the Paper:*	*Credits*			
MCA 517	Lab – V B (IS)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to

- explain different online security tools to the students

Prerequisite:

MCA 515.

Learning Outcome:

On completion of the course, students will be able to:

- Apply various security tools.
- Perform Project on Internet Security.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Introduction to Internet security tools
- C and Unix Programming
- Tracing the source of attacks
- TLS programming
- Study of various network attacks techniques and methods
- Case Studies and Project.

Course No:	*Title of the Paper:*	*Credits*			
MCA 527	Lab – V B (IoT)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to

- Give ideas on IoT practical.

Prerequisite:

MCA 525.

Learning Outcome:

On completion of the course, students will be able to:

- Perform Project on IoT.

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Introduction to IoT tools
- Programming in Python
- Arduino Programming
- Case Study: Agriculture, Healthcare, Activity Monitoring.

Course No:	*Title of the Paper:*	*Credits*			
MCA 537	Lab – V B (NSA)	L: 0	T: 0	P: 1	Total: 1

Objective:

This course is designed with an objective to

- Explain the network and system administration,
- Installation of OS to day-to-day administrative tasks
- Management of user accounts and disk space,
- Imparting the troubleshooting skills

Prerequisite:

MCA 535.

Learning Outcome:

On completion of the course, students will be able to:

- Installation of OS to day-to-day administrative tasks such as Network and Server Configurations,
- Install and configure networking services for intranet and Internet domains (Networking)
- Install and configure Linux and Windows virtual machines (Virtualization), deploy systems to manage large amounts of data for a wide variety of users (Data Centres)

Total Marks: 50

(In Semester Evaluation –20 & End Semester Evaluation-30)

- Server/Client Installation over VMware Environment
- Packet Analysis by using TCPDUMP and WIRESHARK
- Network Practice with Packet Tracer
- System Administration: User/Group management, File System Management ….
- Network Configuration: Start/Stop network Service, network interface configuration
- Firewall Configuration
- DNS and DHCP Configuration and Troubleshooting
- Web and Proxy Server Configuration and Troubleshooting
- Basic Mail Server Configuration and Troubleshooting
- SAMBA, NFS, CUPS and FTP configuration and Troubleshooting
- Webmin / SSH configuration

Course No:	*Title of the Paper*	*Credits*		
MCA 601	System Development Project	Internal Evaluation: 8	External Evaluation: 16	Total: 24

Objective:

The course is designed with an objective to

- Create a real time project preferably in relevant companies / industries / firms.

Learning Outcome:

On completion of the course, students will be able to:

- Implementing the concepts of programming in developing real time projects.

Total Marks: 300

Internal Evaluation: 100,

External Evaluation: 200 (Project Work: 150, Seminar / Viva: 20, Project Report:30)

Project Guidelines:

As per the latest guideline available in the Centre's website "https://www.ccsdu.in".