MCA code : C561

DAVANGERE UNIVERSITY

Department of Studies in Computer Applications (MCA)

Course Structure and Scheme of Examination under CBCS Programme

Master of Computer Application (MCA)

Chairman
DoS in Computer Applications(MCA)
Davangere University
Shivagangotri, Davangere-07

4/4/2024

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Professor & Dean, Science & Technology
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4/4/2024

Registrar
Davangere University
Shivagangotri, Davangere

Detailed Syllabus Effective from the

Academic Year : 2023-24

Master of Computer Applications (MCA) * Davangere University *
No.
Date
Sign.

MCA Course Structure- W.E.F 2023-2024

SEMESTER-I

SEMESTER	Course Code	Title of the Paper	Instruction Hrs./week	Course Type	Marks			Credits	Examination duration (Hrs.)
					Examination	Internal Assessment	Total Marks		
I	**CORE PAPERS**								
	23MCA101	Data Structures and Algorithms	4	DSC	70	30	100	4	3
	23MCA102	Object-Oriented Programming with C++	4	DSC	70	30	100	4	3
	23MCA103	Operating Systems	4	DSC	70	30	100	4	3
	23MCA104	Database Management Systems	4	DSC	70	30	100	4	3
	23MCAL11	Data Structures and Algorithms Using C++ Lab	4	DSC	40	10	50	2	3
	23MCAL12	DBMS Lab	4	DSC	40	10	50	2	3
	***Bridge Course(BC): Choose any ONE of the following subjects** (*These courses are not included for Percentage and only for auditing purpose)								
	23MCABC1	Fundamentals of Information Technology (Non-Computer Science Students)	2	BC	40	10	50	2	2
	23MCABC2	Accountancy and Financial Management (Computer Science Students)	2	BC	40	10	50	2	2
	ELECTIVE PAPERS (Students are permitted to choose any **ONE** of the following subjects)								
	23MCAE11	Cyber Security and Digital Forensics	4	DSE	70	30	100	4	3
	23MCAE12	Embedded Systems	4	DSE	70	30	100	4	3
	23MCAE13	E-commerce and E-governance	4	DSE	70	30	100	4	3
	23MCAE14	Cloud Computing	4	DSE	70	30	100	4	3
	23MCAE15	Discrete Mathematics and Graph Theory	4	DSE	70	30	100	4	3

NOTE: Total number of credits for I semester: 24+02(BC)

SEMESTER-II

Semester	Course Code	Title of the Paper	Instruction Hrs./week	Course Type	Marks			Credits	Examination duration (Hrs.)
					Examination	Internal Assessment	Total Marks		
II	**CORE PAPERS**								
	23MCA201	Data Communication and Computer Networks	4	DSC	70	30	100	4	3
	23MCA202	Digital Image Processing	4	DSC	70	30	100	4	3
	23MCA203	Advanced Java Programming	4	DSC	70	30	100	4	3
	23MCA204	Web Programming	4	DSC	70	30	100	4	3
	23MCAL21	Advanced Java and Networking Lab	4	DSC	40	10	50	2	3
	23MCAL22	Web Programming Lab	4	DSC	40	10	50	2	3
		**Mandatory Credits: English Language Communication Skill	2	MC	--	--	--	2	--
	ELECTIVE PAPERS (Students are permitted to choose any **ONE** of the following subjects)								
	23MCAE21	Internet of Things	4	DSE	70	30	100	4	3
	23MCAE22	Artificial Intelligence	4	DSE	70	30	100	4	3
	23MCAE23	Applied Cryptography and Network Security	4	DSE	70	30	100	4	3
	23MCAE24	Data Mining and Data Warehousing	4	DSE	70	30	100	4	3
	23MCAE25	Design Thinking	4	DSE	70	30	100	4	3
	23MCAE26	Bio-Informatics	4	DSE	70	30	100	4	3
	23MCAE27	Theory of Computation	4	DSE	70	30	100	4	3

NOTE: Total number of credits for II semester: 24+02(MC)

SEMESTER-III

Semester	Course Code	Title of the Paper	Instruction Hrs./week	Course Type	Marks			Credits	Examination duration (Hrs.)
					Examination	Internal Assessment	Total Marks		
III		**CORE PAPERS**							
	23MCA301	Python Programming	4	DSC	70	30	100	4	3
	23MCA302	Machine Learning	4	DSC	70	30	100	4	3
	23MCA303	Big Data Analytics	4	DSC	70	30	100	4	3
	23MCA304	Software Engineering	4	DSC	70	30	100	4	3
	23MCAL31	Machine Learning using Python Lab	4	DSC	40	10	50	2	3
	23MCAL32	Big Data Analytics Lab	4	DSC	40	10	50	2	3
		**Mandatory Credits: Personality Development	2	MC	--	--	--	2	--
	OPEN ELECTIVE PAPER (Students are permitted to choose any **ONE** of the Subjects offered by the various Departments of the University)								
	23MCAO31	OPEN ELECTIVE PAPER	2	OE	40	10	50	2	2
	ELECTIVE PAPERS (Students are permitted to choose any **ONE** of the following Subjects)								
	23MCAE31	MEAN and MERN Web Development	4	DSE	70	30	100	4	3
	23MCAE32	Block chain Technology	4	DSE	70	30	100	4	3
	23MCAE33	Mobile Application Design and Development	4	DSE	70	30	100	4	3
	23MCAE34	DevOps	4	DSE	70	30	100	4	3
	23MCAE35	Introduction to NLP and chatGPT	4	DSE	70	30	100	4	3
	23MCAE36	Hyper Automation	4	DSE	70	30	100	4	3
	23MCAE37	Research Methodology	4	DSC	70	30	100	4	3

NOTE: Total number of credits for III semester: 24+02(OE)+02(MC)

SEMESTER-IV

Semester	Course Code	Title of the Paper	Instruction Hrs./week	Course Type	Marks			Credits	Examination duration (Hrs.)
					Examination	Internal Assessment	Total Marks		
IV		CORE PAPERS							
	23MCA401	Major Project work	3 2	DSC	160	40	200	16	3
	23MCA403	Seminar	2	DSC	-	50	50	2	-
	Total marks and Credits of all 4 Semesters		-	-	-	-	2150	94	-

NOTE: Total number of credits for IV semester: 18

Total Credits of the Course (I – IV Semesters):

90 + 02(Bridge Course) + 02(Open Elective) + 04(Mandatory Credits) = 90+08=98

Total marks of the Course: 2150

Open Elective Subjects offered by the Department during III Semester (For Other Discipline)

Semester	Course Code	Title of the Paper	Instruction Hrs./week	Course Type	Marks			Credits	Examination duration (Hrs.)
					Examination	Internal Assessment	Total Marks		
III									
	23MCAOE01	Web Technology	2	OE	40	10	50	2	2
	23MCAOE02	Basics of Latex	2	OE	40	10	50	2	2
	23MCAOE03	Problem Solving Techniques	2	OE	40	10	50	2	2

* **Soft Skills (MOOCs / SWAYAM/ NPTEL Courses): Students are encouraged to take this Courses During I to IV Semester**

** MC (**Mandatory Credits-04 credits) – As per University Guidelines-These courses are conducted During II and III Semester**

VISION

To promote an excellent academic and research environment for innovation and development of software through sustainable technical education

MISSION

- To offer high-grade, value-based Post-graduate and Doctoral programmes in the field of Computer Applications.
- To utilize technical knowledge of students towards social issues through various group activities and events.
- To seek innovation and excellence in teaching.
- To encourage and understand the diverse view points and logical thinking.

COURSE OBJECTIVES:

Master of Computer Applications (MCA) is a professional degree in computer science. MCA is a two year long professional post-graduate degree course for students who deeply want to learn computer application development. The MCA course is a combination of both theoretical and practical knowledge. The programme includes software engineering, system development, natural computation, mathematical foundations and artificial intelligence.

- MCA PG Graduates will acquire the knowledge about the current technologies, trends, tools, theory of Computer Science and software development concepts to develop applications and to identify the potential problems where creative computer-based solutions can be applied to solve the problems.
- MCA PG Graduates will be successful software professionals in IT industry capable of assimilating new information and understanding newer technology and its application domain to provide efficient and effective software solutions wherever possible.
- MCA PG Graduates will inculcate the skills of communicating proficiently and collaborate successfully with peers, colleagues and organizations for higher studies, research and entrepreneurship to create new applications for the betterment of the society and their better future.

OUTCOME BASED LEARNING:

MCA graduates will be able to apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement. Design and develop applications to analyze and solve all computer science related problems.

PROFESSIONAL DEVELOPMENT: To train the students to acquire knowledge in their chosen programme and apply professionally and ethically with responsibility towards the need of the society

CORE PROFICIENCY: To expertise the students to organize, understand, evaluate, and solve problems by providing hands on experience through modern tools necessary for practice.

TECHNICAL ACCOMPLISHMENTS: To equip the students with the talent to interpret in core applications by building up a multidisciplinary concept.

PROFESSIONALISM: Inculcating professional behaviour, strong ethical values, innovative research capabilities and leadership abilities.

LEARNING ENVIRONMENT: To provide quality learning experiences through effective classroom practices, active learning styles of teaching, and opportunities for meaningful interaction between students and faculty.

COURSE OUTCOME:

After successful completion of MCA degree, the graduates will be able to:

- Get enhanced Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- It helps to Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences and relevant domain disciplines
- Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- Discover a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.
- Involve in perennial learning for a continued career development and progress as a computer professional upholding the ethics, social, cultural and cyber regulations. Apply the inherent skills with absolute focus to function as a successful entrepreneur.

SPECIFIC OBJECTIVES OF THE PROGRAMME:

- Understand the concepts and applications of major subjects of Computing Sciences like Web designing and development, Mobile application development, and Network and communication technologies.
- Apply Technology/Engineering knowledge to analyze, design and develop computing solutions by employing modern computer languages, environments and platforms that can solve complex problems.
- Understand the technological developments in the usage of modern design, enhance research and development tools to analyze and design for a variety of applications.
- Inculcate the knowledge of Science/Engineering and Technology principles to manage software projects effectively and create innovative career path ahead in the future.

Fundamentals of Information Technology

1st Semester - Hardcore Component LTP:: 2:0:0	Total Credits:2 Hours: 2 hrs./week
Programme: Master of Computer Applications Course Code: : 23MCABC1	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Outcome

- To introduce the fundamental concepts of computers and computing environment.
- To acquire the basic knowledge of algorithm design and problem solving using computers.
- To understand the concept of database management system and its importance.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 26)

UNIT - 1

Digital computers and Digital system: Number systems, Number base conversion, Complements, Fundamentals of Computers. Introduction to Operating System. Problem solving techniques: Introduction, Problem solving procedure. Algorithm: Steps involved in algorithm development, Algorithms for simple problems, Flowcharts, Psuedocode. Introduction to C: Overview of C Program, Basic structure of a C - program. Constants, Variables & Data types: Character set, C token, Keywords & identifiers. Control Statements, functions, structures and unions. Data Structure: Types of Data structures, Arrays, Queues, Linked list, Trees, Searching and Sorting Algorithm: Searching – Introduction, Linear search, Binary Search, Sorting - Introduction, bubble sort, Insertion sort, Selection sort, Merge sort. Comparisons of searching and sorting techniques.

UNIT - 2

Database System concepts and architecture: Data Models, Schemas, and Instances, Three- schema architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Classification of Database Management Systems. Relational Data Model: Relational Model Concepts, Relational model Constraints and Relational Database Schemas, Update Operations, transactions and Dealing with Constraint Violations. SQL :Data manipulation in DBMS, Data types, SQL commands: Create Table, Inserting data, SELECT, DELETE, UPDATE, ALTER TABLE, DROP TABLE, RENAME, DESCRIBE.

Reference Books

1. E. Balagurusamy, Programming in ANSI C, 7th Edition, Tata McGraw Hill.

2. Introduction to Information Technology ITL education solution Ltd, Second Edition

3. K.R. Venugopal and Sudeep R Prasad, Programming with C, 4th Edition, Tata McGraw- Hill Education.

4. Yashavant P. Kanetkar, Let Us C, 10th Edition, Tata McGraw Hill, 2010.

5. M.Morris Mano, Digital Logic and Computer design, PHI, 2015

6. Thomas L Floyd, Digital Fundamentals, 10th Edition, Pearson, 2011.

7. Thomas. C. Bartee, Digital Computer Fundamentals, 6th edition, TMH.

8. RamezElmasri and ShamkanthB.Navate, Fundamentals of Database Systems, 7th Edition, Pearson Education 2.

9. Ivan Bayross, SQL/PL/SQL- the Programming language of Oracle, 2nd Revised edition (or 4th revised Ed), BPB Publications.

10. Seymour Lipschutz, Data Structures with C, Schaum's Outlines Series, Tata McGraw Hill, 2011.

11. Horowtz Shani and etc et. Fundamentals of Data Structures in C, Universities Press, 2nd edition, 2008.

12. R. Venkatesan and S. Lovelyn Rose, Data Structures, First Edition:2015 , Wiley India Pvt. Ltd. Publications.

Accountancy and Financial Management

1st Semester - Hardcore Component LTP:: 2:0:0	Total Credits:2 Hours: 2 hrs./week
Programme: Master of Computer Applications Course Code: : 23MCABC2	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Outcome:

- Understand the basics of accountancy and financial management.
- Able to prepare trading accounts, balance sheet, profit and loss account.
- Able to perform ratio analysis and fund flow management.
- Acquire the knowledge about budgetary control, standard costing, marginal costing, capital budgeting.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 26)

Unit-1:

Fundamentals of accounting: Meaning of the book keeping, Objectives and Benefits, Accounting concept and conventions, journal, ledger, trial balance, and subsidiary books. **Sole trading accounts:** Preparation of trading accounts, profit and loss account and balance sheet, problems on balance sheets.

Unit-2:

Ratio analysis: Meaning uses, kinds of ratios a) Liquidity ratios b) profitability ratios c) turnover ratios Simple problems on ratio analysis. **Fund Flow statement:** Meaning uses, limitations, preparation of Statement of changes in working capital Statement of fund flow operations Fund flow statement. **Costing:** Nature and importance of cost clarification and preparation of cost sheet. Overview of Budget and Budgetary control, Standard Costing, Marginal Costing,

Capital Budgeting: Meaning, kinds of capital budgeting (theory), problems on Payback period method, Accounting Rate of return method, Net present value (NPV) method, internal rate of return method, Profitability index. Tally software can be used to demonstrate business functionalities including accounting, finance, inventory, sales, purchase, point-of-sales, manufacturing, job costing, and payroll and branch management.

Text books:

1. Management Accountancy: Sarkar.N
2. Ravi M Kishore, Financial Management.
3. Financial management: I.M.Pandey.
4. Accountancy: B.S.Raman
5. Management Accounting – Tools and techniques: N Vinayakam and Sinha
6. Principals of accounting, PHL: Levy and Samat

Note:

1. The **BRIDGE COURSE** entitled **Fundamentals of Information Technology** is for B.Sc. /B.A. / B.Com with Mathematics at 10 + 2 Level or Graduation level.
2. The **BRIDGE COURSE** entitled **"Accountancy and Financial Management"** is for the students who take admission with BCA/B.Sc. degree with Computer Science as a cognate subject (With additional bridge Course as per the norms of the concerned University).
3. Open Elective and Bridge Course Marks are Not Added to the Percentage/CGPA (as per university regulations)

DATA STRUCTURES AND ALGORITHMS

1st Semester - Hardcore course LTP: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA101 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic of computer programming language and basics of mathematics.

Course Outcome:

- Understand the importance of various types of data structures in solving a problem through programming.
- Able to identify the suitability of a particular data structure to solve a problem.
- Critically evaluate the efficient representation of data structures in the memory. Elucidate the various operations performed on a particular data structure.
- Understand the importance of indexing and how it is achieved through a particular data structure.
- Skill development: After completion of Data Structures and Algorithms course, the students will have enhanced programming knowledge to implement efficient software applications.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

INTRODUCTION TO DATA STRUCTURES: Concept of data type, Definition of data structure, Types of data structures. Arrays: Representation, processing single and multidimensional arrays, operations on arrays.

LINEAR DATA STRUCTURE: Stacks: definition, representation of a stack in memory, operations on stack, multiple stacks, application of stacks. Queue: definition, representation of a queue in memory, operations on queues, types of queues – linear, circular, dequeue, priority queue, applications of queue. Linked list: definition, representation of a linked list in memory, operations on linked list.

UNIT-2

NON-LINEAR DATASTRUCTURE: Trees: Types - Binary tree, Binary search tree, AVL tree, Btree, B+tree. Heaps: introduction, min heap, max heap. HASHING: Hashing and hash tables: Definition, Hash functions, Types of hash functions, Rehashing. Files: Definition, Basic

terminologies, Attributes of a file, Classification of files, Operations on files. Types of file organization: sequential, relative, indexed and multi-key file organizations

UNIT-3

GRAPH: Introduction, Types of Graph. Graph Algorithms: Breadth-First Search, Depth-First Search, Shortest Paths, Maximum Flow, Minimum Spanning Trees. Number Theoretic Algorithms, Polynomial Arithmetic, Fast Fourier Transform, String Matching Algorithms. Advanced Algorithms: Parallel Algorithms for Sorting, Searching and Merging, Approximation Algorithms, Randomized Algorithms.

UNIT-4

PERFORMANCE ANALYSIS OF ALGORITHMS AND RECURRENCES: Time and Space Complexities; Asymptotic Notation, Recurrence Relations. Design Techniques: Divide and Conquer; Dynamic Programming, Greedy Algorithms, Backtracking, Branch and Bound.

Text/Reference Books:

1. Data Structures: A Pseudocode Approach with C Richard Gilberg, Behrouz A. Forouzan 2nd 2004
2. Data Structures Using C and C++ YedidyahLangsam, Aaron M. Tenenbaum 2nd 2015
3. Data Structures and Algorithms Andrew Tanenbaum 2nd 2006
4. An Introduction to Data Structures, with Applications Trembley and Sorenson McGraw Hill
5. Fundamentals of Data Structures Ellis Horowitz and Sartaj Sahni 2nd 2008
6. Data Structures Horowitz and Sahni: SBCS Publication

OBJECT ORIENTED PROGRAMMING WITH C++

1st Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA102 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic of computer programming language and basics of mathematics.

Course Outcome:

- Justify the philosophy of object-oriented design and the concepts of encapsulation, abstraction, in- heritance, and polymorphism.
- Design, implement, test, and debug simple programs in an object-oriented programming language.
- Describe how the class mechanism supports encapsulation and information hiding.
- Compare and contrast the notions of overloading and overriding methods in an object- oriented language.
- Skill development: After completion of *Object Oriented Programming with C++* course, the students will have enhanced programming knowledge on OOPs with C++ to implement efficient/needed soft- ware applications.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction: Procedure-oriented programming, Concepts of Object-oriented programming, benefits of OOP, Applications of OOP, Structure of C++ program. Tokens, Keywords, Identifiers and constants, Basic Data Types, User-defined data types, derived data Types, Symbolic constants, Type compatibility, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Member dereferencing opera- tors, Memory management operators, Manipulators, Type cast operator, Expressions and their types, Special assignment expressions, Implicit conversions, Operator overloading, Operator precedence, Control structures.

UNIT-2

Functions: The main function, Function prototyping, Call by Reference, Return by Reference, Inline functions, Default arguments, constant arguments, Function overloading, Friend and Virtual functions. Classes and Objects: Specifying a Class, Defining member functions, Making an Outside

function Inline, Nesting of member functions, Private member functions, Arrays within a Class, Static data members, Static member functions, Arrays of Objects, Objects as function arguments, friendly functions, Returning Objects, constant member functions, Pointers to members.

UNIT-3

Constructors and Destructors: Constructors, Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructor, Constructing Two-dimensional arrays, constant Objects, Destructors. Operator overloading and Type Conversions: Defining operator overloading, Overloading unary operators, Overloading Binary operators, Rules for overloading operators, Type conversions.

UNIT-4

Inheritance and Polymorphism: Introduction, defining derived classes, single inheritance, making a private member inheritable, multilevel inheritance, hierarchical inheritance, hybrid inheritance, virtual base classes, abstract classes, constructors in derived classes, polymorphism – introduction, pointers, pointers to objects, this pointers, pointers to derived classes, virtual functions, pure virtual functions.

Text/Reference Books:

1. Object Oriented Programming with C++ , M.T. Somashekara, D.S. Guru, H.S. Nagendraswamy, K.S. Manjunatha, PHI Learning, New Delhi, 2012
2. Object Oriented Programming with C++ by E. Balagurusamy
3. Object Oriented Programming in C++ by Robert LaforeTechmedia Publication.
4. The complete reference C – by Herbert shieldt Tata McGraw Hill Publication.

OPERATING SYSTEMS

1st Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs/week
Programme: Master of Computer Applications Course Code: :23MCA103 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Knowledge of C, Computer Organization and Architecture, x86 Assembly level programming.

Course Outcome:

- Understand the principles and methods for resource-analysis for embedded- and real- time systems.
- Acquire good knowledge of the relevant mechanisms and methods in operating systems and hardware that have influence on real-time aspects, principles and methods for design and construction of embedded- and real-time systems.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Operating System, Types of operating systems, Operating systems structures Systems components, Operating system services, System calls, System programs, Process concept, Operation on processes, Co-operating processes, Inter process communications, CPU scheduling: Scheduling criteria, Scheduling algorithms.

UNIT-2

Process concepts, process state, process control block, multithreaded programming, Deadlock: Deadlock Characterization, prevention, detection, avoidance, Recovery from Deadlock Synchronization. Critical section problem, Semaphores, Classical problems of synchronization: Dinning Philosopher's problem, Bounded buffer problem, Reader's- Writers problem.

UNIT-3

Paging-Segmentation Virtual Memory, Demand paging, Page Replacement, Thrashing, Disk Structures: Disk Scheduling, Free Space management, Distributed File systems, Naming and Transparency File Systems Interface: File concepts, Access methods, Directory Structures. File System Implementation.

UNIT-4

Introduction of UNIX : Introduction, Architecture, Experience the Unix environment, Basic commands ls, cat, cal, date, calendar, who, printf, tty, sty, uname, passwd, echo, tput, bc, script, spell and ispell. The parent-child relationship, pwd, the Home directory, absolute pathnames, using absolute pathnames for a command, cd, mkdir, rmdir, Relative pathnames, The UNIX file system. Introduction to the Shell: Introduction to Shell Scripting, Shell Scripts, read, Command Line Arguments, Exit Status of a Command, The Logical Operators AND AND and | |, exit, if, and case conditions, expr, sleep and wait, while, until, for, $, , redirection. The here document, set, trap, Sample Validation and Data Entry Scripts. Basic File Attributes: Is – l, the –d option, File Permissions, chmod, Security and File Permission, users and groups, security level, changing permission, user masks, changing ownership and group, File Attributes, More file attributes: hard link, symbolic link, umask, find.

Text/Reference Books:

1. Operating Systems Concepts Abraham Silberschalz Peter B Galvin, G.Gagne, Addision Wesley Pub-lishing Co. 7th 2010
2. Modern operating Systems Andrew S.Tanenbaum, PHI Learning Pvt.Ltd. 3rd 2008
3. Operating Systems: Internals and Design Principles William Stallings Prentice Hall 7th 2011
4. Operating Systems H M Deital, P J Deital and D R Choffnes, Pearson Education 3rd 2011
5. Operating Systems: A Concept-based Approach. D M Dhamdhere Tata McGraw-Hill Education 2nd2007
6. ”Unix Shell Programming”, YashwantKanetkar.
7. ”Beginning Shell Scripting”, Eric Foster -Johnson, John C Welch, Micah Anderson, Wrox publication.
8. ”Introduction to UNIX” by M G Venkatesh Murthy.
9. Your UNIX-The Ultimate Guide, Sumitabha Das, Tata McGraw Hill,

DATABASE MANAGEMENT SYSTEMS

1st Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA104 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Knowledge of C programming language.

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

- Understand the basic concepts and the applications of database systems.
- Master the basics of SQL and construct queries using SQL.
- Understand the relational database design principles.
- Implementing security and integrity policies relating to databases
- Skill development: After completion of DBMS course, the students would get the fundamentals of data base, skills to develop for a career in SQL programming.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

Unit 1

Introduction and data models: problem with file-based system, introduction to database and database management system. Objective of database management. Overview of DBMS. Database administrator. Database designer, End users, Data modelling for a database, Features of DBMS, three level architecture, ER Models, data model classification, different types of keys.

Unit 2

RDBMS and normalization: The Relational Model: Relational database, relational algebra, relational calculus SQL- Data definition, relational database manipulation using SQL, DDL, DML, DCL, TCL, DQL, views, embedded data manipulation. Relational Database Design: Anomalies in a database, functional dependency, normalization – 1NF, 2NF, 3NF, BCNF and 4NF. Limitations of 4NF and BCNF. Canonical cover, lossless joins, dependency preservation, multi value dependency and higher normal forms. Denormalization.

Unit 3

Transactions, Concurrency Control, Recovery Techniques Basic concept; ACID properties; transaction state; implementation of atomicity and durability; concurrent executions; basic idea of serializability; view and conflict serializability Recovery Techniques Failure Classification , Storage Structure, Recovery and Atomicity Log Based Recovery, Shadow Paging ,stable storage implementation, data access; recovery and atomicity - log based recovery, deferred database modification, immediate database modification, checkpoints.

Unit 4

Emerging fields in DBMS Distributed databases; basic idea; distributed data storage; data replication; data fragmentation horizontal, vertical and mixed fragmentation. Concepts of Multimedia databases, Object oriented data base management systems. Data Warehousing & mining.

Text/Reference Books:

1. Elmsari and Navathe, "Fundamental of Database System", Addison Wesley. New York.
2. H.Korth & A. Silberschatz, “DATABASE SYSTEM CONCEPTS”, TMH.
3. Bipin C Desai, An Introduction to Database Systems, Galgotia Publications
4. Silberschatz A, Korth H.F and Sudarshan S, Database System Concepts, Tata McGraw Hill
5. S K Singh, Database Systems-Concepts, Design and Applications, Pearson Education.
6. Date, C. J., an Introduction to Database Systems, Addison-Wesley.
7. Ullman. J.D, "Principles of Database Systems", Galgotia Publications, New Delhi.

DATA STRUCTURES AND ALGORITHMS USING C++ LAB

1st Semester - Hardcore course LTP:: 0:0:2	Total Credits:2 Lab Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAL11 Exam Hours: 3	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C language, algorithmic and problem solving skills.

Course Outcome: On the completion of this laboratory course, the students will be able to:

- Analyze and Compare various linear and non-linear data structures.
- Demonstrate the working nature of different types of data structures and their applications.
- Develop, analyze and evaluate the searching and sorting algorithms.
- Choose the appropriate data structure for solving real world problems.
- Skill development: After completion of Advanced Data Structures course, the students will have enhanced programming knowledge to implement efficient software applications.
- Skill development: After completion of Data Structures Lab course, the students will have enhanced programming knowledge to implement efficient software applications.

Course Content:

INSTRUCTION-1. Laboratory programs should be conducted as per the respective theory syllabus.

INSTRUCTION-2. Minimum number of programs should be 30 among that 15 programs from PART-A to have basic programs and other 15 programs from PART-B to have extended or enhanced programs.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

DBMS LAB

1st Semester - Hardcore course LTP:: 0:0:2	Total Credits:2 Lab Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAL12 Exam Hours: 3	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C language, algorithmic and problem solving skills.

Course Outcome: On the completion of this laboratory course, the students will be able to:

- Students get practical knowledge on designing and creating relational database systems. Understand various advanced queries execution.
- Able to provide an environment that is both convenient and efficient to use in retrieving and storing data base information.
- Skill development and Employability: After completion of DBMS Lab course, the students will have enhanced Algorithms skills to implement any software applications along with queries of Data base.

Course Content:

INSTRUCTION-1. Laboratory programs should be conducted as per the respective theory syllabus.

INSTRUCTION-2. Minimum number of programs should be 30 among that 15 programs from PART-A to have basic programs and other 15 programs from PART-B to have extended or enhanced programs.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

CYBER SECURITY AND DIGITAL FORENSICS

1st Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE11 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic of Computer viruses, computer programming language and basics of security.

Course Outcome:

- Learn the cyber threat landscape, both in terms of recent emergent issues and those issues which recur over time.
- Learn the roles of governments, commercial and other organizations, citizens and criminals in cyber security affairs.
- Understand general principles and strategies that can be applied to systems to make them more robust to attack.
- Understand key factors in cyber security from different disciplinary views including computer science, management, law, criminology, and social sciences.
- Notice issues surrounding privacy, anonymity and pervasive passive monitoring.
- To understand the basic digital forensics and techniques for conducting the forensic examination on different digital devices.
- Skill development: After completion of Cyber Security and Digital Forensics course, the students will have enhanced Cyber Security Skills and Digital Forensics on software crimes and its evaluation.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

Unit 1

Introduction to Cyber Crime: Information Security, Classification of Cybercrime, Indian IT Act 2000, Cyber Offences & Cyber Crime: Concept of Cyber Space & Cyber Law: E-commerce, contract aspects, security aspects. Intellectu**a**l property aspects, Criminal aspects Information Technology Act: IT Act 2000, penalties, Adjudication, Offences.

Unit 2

Strategic Attacks, Types of Attacks, Authentication Service Security, Attacks on mobile phones, Methods & tools used in Cyber Line:, Password Cracking, Malware, DoS & DDoS Attacks, SQL injection , Buffer overflow, Phishing & identity theft, Attacks on wireless network.

Unit 3

Principles of Security, Cryptography: Concepts & Techniques: Transposition Techniques, Substitution Techniques, Symmetric & Asymmetric Key Cryptography , Advanced Encryption Standard, Data Encryption Standard, 2 DES, RSA algorithm.

Unit 4

Diffie hellman Key exchange, Digital Signature Technique, Digital Certificates and PKI, User Authentication & Kerberos.

Text book:

1. Cryptography & Network Security, Authul Kahate. McGrew-Hill Publication, 2nd Edition. Chapter-1 to 7, 9
2. Cyber Security & Cyber Laws, Nilakshi Jain, Ramesh Menon, Wiley Publications, Chapter-1 to 3, 5.

References:

1. Graham, J. Howard, R., Olson, R. (2011). Cyber Security Essentials.
2. Stallings, W., Brown, L. (2018). Computer Security - Principles and Practice.
3. Andress, J., Cyber Warfare (2013). Techniques, Tactics and Tools for Security Practitioners.

EMBEDDED SYSTEMS

1st Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE12 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

Basic of C programming language and basics of Hardware.

Course Outcome: On completion of this course, successful participants will be able to:

- Perform effectively as entry level Embedded Systems professionals.
- Develop and maintain applications written using Embedded C.
- Independently design and develop a hardware platform encompassing a microcontroller and peripherals.
- Process helps effectively translate project requirements into product specifications and eventually into a product that meets project objectives within the identified design constraints.
- Skill development: After completion of Embedded Systems course, the students will have enhanced carrier in Embedded Systems.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Microprocessor and Microcontroller: Memory Classification, Registers and Memory of AT89C51. Introduction of EMBEDDED C: Introduction to C and Embedded C, Programming , Basic structure of C program Constants, Variables and Data Types, Keyword- s and Identifiers, Data type and its memory representation, Arrays and strings, Operators. Control Structure and loops: if, if. . . .else, switch, while, do – while, for and goto statements. Functions: Types, a Multi-functional program, Return values and their types.

UNIT-2

INTRODUCTION TO SOFTWARES: Kiel Compiler, Proteus, INTERFACING OF LED, Introduction of LED's, Interfacing Circuit Description of LED's, Programming of LED's Interfacing, Interfacing of Seven Segment Display. Introduction to 7 Segment Display: Types of 7 Segment Display, Interfacing Circuit Description of 7 Segment Display, Programming of 7

Segment Dis- play Interfacing. Interfacing of LCD: 16 x 2 LCD, Commands of 16 x 2 LCD Interfacing Circuit Description of 16 x 2 LCD, Programming of 16 x 2 LCD.

UNIT-3

Interfacing of Switches and Keyboard Matrix: Interfacing Circuit of Switches and Keyboard Matrix, Programming of Keyboard Matrix and Switches, Controlling of LED's by using Switches, Key board Matrix and LCD Interfacing Program, Interfacing of Motors: Types of Motors used in Embedded System, Programming and Controlling of motors in, Embedded System, Timers and Counters Programming. Introduction to Timers and Counters: Description of SFR associated with Timers and Counters, Programming of Timers and Counters, Serial Communication Programming.

UNIT-4

Introduction to Serial Communication: Types of Serial Communication, Description of SFR associated with Serial Communication, Programming of UART, Interfacing of ADC, and Introduction to ADC, Programming of ADC, and Sensor Interfacing. Introduction to sensing devices: Interfacing of IR Sensors, Interfacing of Temperature Sensor, Embedded Networking, I2C Bus Standard, Bluetooth, Zigbee, USB, UART.

Text/Reference Books:

1. Programming Embedded Systems with C and GNU Development Tools by Michael Barr, Anthony Massa 2006
2. Embedded C Programming Techniques and Applications of C and PIC MCUS by Mark Siegesmund 2014
3. C Programming for Embedded Systems by Kirk Zurell 2000
4. EMBEDDED SYSTEM DESIGN: A UNIFIED HARDWARE/SOFTWARE INTRODUCTION by Vahid 2006
5. C Programming for Embedded Systems by Kirk Zurell 2000

E-COMMERCE AND E-GOVERNANCE

1st Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE13 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic knowledge of Internet, Websites and Administration.

Course Outcome: On completion of this course, successful participants will be able to:

- Helps in reducing the cost of products, so less affluent people can also afford the products.
- E-commerce helps the government to deliver public services such as healthcare, education, social services at a reduced cost and in an improved manner.
- E-governance facilitates smooth transactions, storing and retrieval of data for implementation of governance, faster processing of information, expedite decision making, responsible and transparent governance and ensure accountability of decision making.
- Skill development: After completion of E-commerce and E-governance course, the students will have better knowledge on E-commerce and E-governance.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

E-commerce and its Technological Aspects: Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Electronic Market, Electronic Data Interchange, Internet Commerce, Benefits and limitations of E-Commerce, Produce a generic framework for E-Commerce, Architectural framework of Electronic Commerce, Web based E Commerce Architecture. E-Retailing: Traditional retailing and e retailing, Benefits of e retailing, Key success factors, Models of e-retailing, Features of e retailing. E services: Categories of e-services, Web-enabled services, and matchmaking services, Information-selling on the web, e entertainment, Auctions and other specialized services. Business to Business Electronic Commerce.

UNIT-2

Electronic Data Interchange: Benefits of EDI, EDI technology, EDI standards, EDI communications, EDI Implementation, EDI Agreements, EDI Security. Electronic Payment Systems, Need of Electronic Payment System: Study and examine the use of Electronic Payment system and the protocols used, Study Electronic Fund Transfer and secure electronic transaction

protocol for credit card payment. Digital economy: Identify the methods of payments on the net – Electronic Cash, cheques and credit cards on the Internet. Threats in Computer Systems: Virus, Cyber Crime Network Security: Encryption, Protecting Web server with a Firewall, Firewall and the Security Policy, Network Firewalls and Application Firewalls, Proxy Server.

UNIT-3

Introduction to E-Governance: Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G);Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models. E-Government Infrastructure Development: Network Infrastructure; Computing Infrastructure; Data centers; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness.

UNIT-4

Security for e-Government: Challenges and Approach of E-government Security; Security Management Model; E- Government Security Architecture; Security Standards. Applications of Data Warehousing and Data Mining in Government: Introduction; National Data Warehouses: Census Data, Prices of Essential Commodities; Other Areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors. Case Studies: E-Government Initiatives in USA, Cyber Laws, Implementation in the Land Reform, Human Resource Management Software, NICNET, Collectorate , Computer-aided Administration of Registration Department (CARD), Smart Nagarpalika, National Reservoir Level and Capacity Monitoring System, etc.

Text/Reference Books:

1. Elias. M. Awad,"Electronic Commerce", Prentice-Hall of India Pvt Ltd.
2. Ravi Kalakota, Andrew B. Whinston,"Electronic Commerce-A Manager's guide", Addison-Wesley.
3. Efraim Turban, Jae Lee, David King, H.Michael Chung,"Electronic Commerce–A Managerial Per- spective", Addison-Wesley.
4. Elias M Award,"Electronic Commerce from Vision to Fulfilment", 3rd Edition, PHI,
5. Judy Strauss, Adel El-Ansary, Raymond Frost,"E-Marketing", 3RD Edition, Pearson Education.
6. E-Commerce: Strategy, technology and implantation Cengage Learning by Gary P. Schneider
7. E-Governance, Concepts and case studies By C.S.R. Prabhu, PHI

CLOUD COMPUTING

1st Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE14 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic knowledge of Internet, Websites and Administration.

Course Outcome:

On completion of this course, successful participants will be able to:

- Learn new live concepts on Cloud Computing
- Gain a foundational understanding of a subject and tool
- Develop job-relevant skills with hands-on projects
- Skill development: After completion of *Cloud Computing* course, the students would get the fundamentals of cloud computing, explore popular cloud platforms, and learn about emerging trends like Hybrid Multi cloud, Server less, and DevOps in this beginner-friendly course.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Cloud computing – Cloud components - Essential characteristics – On-demand self-service, Broad network access, Location independent resource pooling ,Rapid elasticity , Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing. Utility and Enterprise grid computing, Cloud scenarios – Benefits: scalability, simplicity, vendors, security, Limitations – Sensitive information. Key Cloud Service Providers and Their Services

UNIT-2

Overview of Cloud Service Model: IaaS - Infrastructure as a Service, PaaS - Platform as a Service, SaaS - Software as a Service, Public Cloud, Private Cloud, Hybrid Cloud. Overview of Cloud Infrastructure: Virtualization and Virtual Machines, Types of Virtual Machines, Secure Networking in Cloud, Containers, and Basics of Storage on Cloud, File Storage, and Block Storage.

UNIT-3

Hybrid Multi-cloud, Server less Computing, Cloud Native Applications, DevOps on the Cloud, Application Modernization, Cloud Security: Introduction to Cloud Security, Identity and Access Management, Cloud Encryption, Cloud Monitoring - Basics and Benefits, Case Studies in Different Industry Verticals, Career Opportunities and Job Roles in Cloud Computing.

UNIT-4

Cloud Simulators- CloudSim and GreenCloud: Introduction to Simulator, understanding Cloud Sim simulator, CloudSim Architecture (User code, CloudSim, GridSim, SimJava) Understanding Working platform for CloudSim, Introduction to GreenCloud. Introduction to VMware Simulator: Basics of VMware, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine.

Text/Reference Books:

1. Cloud computing a practical approach - Anthony T.Velte , Toby J. Velte Robert Elsenpeter, TATAMcGraw- Hill , New Delhi – 2010
2. Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008
3. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, WileyPublishing, Inc, 2010
4. Cloud Computing (Principles and Paradigms), Edited by Rajkumar Buyya, James Broberg, Andrzej Goscinski, John Wiley and Sons, Inc. 2011

DISCRETE MATHEMATICS AND GRAPH THEORY

1st Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE15 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic knowledge on Mathematics, Logics.

Course Outcome:

- Apply concept of Predicate Calculus in computer science like design of computing machines, artificial intelligence, definition of data structures for programming languages etc. (Application)
- Understand the concepts of graph theory, Lattices, and Boolean Algebraic analysis of various computer science applications. (Knowledge, Comprehension)
- Apply the knowledge of Boolean algebra in computer science for its wide applicability in switching theory, building basic electronic circuits and design of digital computers. (Knowledge, Application)
- Understand the application of various type of graphs in real life problem. (Knowledge, Comprehension)
- Apply abstract concepts of graph theory in modeling and solving non-trivial problems in different field of study. (Application, Analysis)

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Predicate Calculus: Proposition, Logical operators and expressions, predicates, Rules of quantifiers. Rules of Inference for propositions and predicates. Lattices: Relation, Poset, Hasse diagram, Lattice as Poset Properties of lattices, Lattice as an algebraic system, Duality.

UNIT-2

Boolean algebra: Definition and properties of Boolean algebra, Sub-Boolean algebra Atoms and anti-atoms, Boolean expression and their equivalences Min-terms and Max-terms, values of Boolean expressions Canonical forms, Karnaugh map.

UNIT-3

Concepts of Graphs and Trees: Definition of a graph theory, incidence and degree, walks, paths, circuits, Connectedness, Eulerian and Hamiltonian graphs, Trees, basic properties of trees, Binary trees Spanning and Minimal spanning trees Matrix representations and Graph Algorithms: Connectivity and Separability, fundamental circuits and cut sets.

UNIT-4

Isomorphism of graphs: 1 and 2-isomorphism Matrix representation of graphs, adjacency and incidence matrix Graph theoretical algorithms: Dijkstra, prims and Kruskal. Planar graphs and their properties: Planarity of graphs, Planar graphs Stereographic projection and embedding on a sphere Kurtowski's two graphs, Euler's formula, Detection of planarity and elementary reduction.

Text/Reference Books:

1. Rosen Kenneth: Discrete mathematics and its applications. McGraw hill- New Delhi.
2. Stanat and McAlister: Discrete Mathematics for Computer Science, PHI
3. Narsingh Deo: Graph Theory with Applications to Engineering and Computer Science, PHI, 1974
4. B. Kolman and R.C. Busby: Discrete mathematical structures for computer science Prantice Hall, New-Delhi.
5. J.P. Tremblay and Manohar: Discrete mathematical structures with application to Computer Science, McGraw hill- New Delhi.
6. S. Malik and M. K. Sen: Discrete Mathematics, Cengage Learning India Pvt. Ltd.
7. Thomas S. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein: Introduction to Algorithms, the MIT Press.

DATA COMMUNICATION AND NETWORKS

2nd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA201 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic understanding of computer hardware and operations.

Course Outcome:

- Understand the data communications system and its components.
- Summarize signal conversions techniques for digital communication.
- Identify and categorize various types of transmission media.
- Understand various analog and digital services for data communication.
- Evaluate bandwidth utilization using multiplexing techniques.
- Implement advanced technique such as Data encoding and Compression for Image processing Applications.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Data Communication, Component and Basic Concepts – Introduction, Characteristics – Delivery, Accuracy, Timeliness and Jitter, Components, Topology – Mesh, Star, Tree, Bus, Ring and Hybrid Topologies Transmission modes – Simplex, Half Duplex, Full Duplex Categories of networks – LAN, MAN, WAN.

UNIT-2

Network Components – Signal Transmission – Analog Signaling, concept of ASK, FSK, PSK, Digital Signaling, concept of Unipolar, Polar, Return-to-Zero(RZ), Biphase, Manchester, Differential Manchester, Non-Return-to-Zero (NRZ), Bit Synchronization, Asynchronous Bit Synchronization and Synchronous Bit Synchronization, Baseband and Broadband Transmissions.

UNIT-3

Transmission Media - Guided Media – Twisted-Pair Cable, Coaxial Cable, and Fiber-Optic Cable Unguided Media – Radio Wave Transmission Systems, Microwave Transmission Systems, Infrared

Transmission Systems and Satellite Communication System. The OSI Model – Functions of all the Seven Layers, Networking Devices.

UNIT-4

Packet Switching Networks – Network Services and Internal Network Operations, Packet Network Topology, Datagrams and Virtual Circuits, Connectionless Packet Switching, Virtual Circuit Packet Switching. Routing Concepts Data Link Issues – Single bit error and Burst Error, concepts of Redundancy, Checksum, Single Bit Error correction and Hamming Code correction method

Text/Reference Books:

1. Introduction to Data Communications and Networking by Behrouz Forouzan.
2. Computer Networks by Andrew S Tanenbaum.
3. Networking Essentials – Third Edition – Jeffrey S. Beasley, Piyasat Nilkaew

DIGITAL IMAGE PROCESSING

2nd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA202 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basics of Linear Algebra, Differential Equations, Probability and Statistics, Calculus, Signals and systems, Digital Electronics, Basic Programming skills (C++, MATLAB or any).

Course Outcome:

- Develop and implement algorithms for digital image processing.
- Apply image processing algorithms for practical object recognition applications.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to digital image processing, Stages, Application areas, components, electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, relationships between pixels, Enhancement in spatial domain, Enhancement in the Frequency Domain- Image Smoothing and Image Sharpening .

UNIT-2

Image Restoration: Model of image degradation/restoration process, noise models, Restoration in the spatial domain: mean filter, order statistics filter, adaptive filters. Restoration in the frequency domain: inverse filtering, Wiener filter.

UNIT-3

Segmentation: Intensity based - point, line and edge. Region based - Boundaries, region growing, Thresholding, splitting and merging, segmentation by morphological watersheds. Motion in segmentation

UNIT-4

Image Compression: Introduction, coding Redundancy, Inter-pixel redundancy, image compression model, Lossy and Lossless compression, Huffman Coding, Arithmetic Coding, LZW coding,

Transform Coding, Sub-image size selection, blocking, Run length coding. Image representation: Boundary Detection, Chain code, Region filtering.

Text/Reference Books:

1. R. C. Gonzalez, R. E. Woods, Digital Image Processing, 3-rd ed. Prentice Hall, Pearson publication.
2. Anil K Jain, Digitial Image Processing, PHI Publication
3. Milan Sonka, Image Processing, Analysis, and Machine Vision, 3rd Edition, CL Engineering(2013)

ADVANCED JAVA PROGRAMMING

2nd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA203 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Knowledge of C programming language.

Course Outcome:

- Use an integrated development environment to write, compile, run, and test simple object- oriented Java programs.
- Read and make elementary modifications to Java programs that solve real-world problems.
- Validate input in a Java program, Identify and fix defects and common security issues in code.
- Document a Java program using Javadoc.
- Use a version control system to track source code in a project.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Java: Origin and features of Java. Java Program Structure, Java Tokens, Java statements, Java Virtual machine, Command Line Parameters, Java Variables and Data Types, Operators, Decision Making, Branching and looping statements. Classes, Objects and Methods used in Java: Class fundamentals, Methods, Constructors, Overloading, Inheritance, Interfaces, One and two dimensional arrays. Java Packages: API pack- ages, system packages, naming conventions, creating and accessing a package, adding a class to a package, hiding classes.

UNIT-2

The Collections Framework (java.util) - Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map. AWS, deprecated Applets.

UNIT-3

Multi-threads Programming: Java thread Model, Main Thread, creating a Thread, Creating Multiple Threads, Extending the thread class, Stopping and blocking a thread, Life cycle of a thread, Managing Errors and Exceptions. Managing Input/output Files in Java: Stream Classes, Byte Stream Classes, Character Stream Classes, Creation of Files, Reading/Writing characters, Reading/Writing Bytes, Handling Primitive Data Types, Concatenating and Buffering Files, Random Access Files. Networking: Internet Address, TCP/IP Client Sockets, TCP/IP Server Sockets, URL, URL Connection, JDBC connectivity.

UNIT-4

Introduction to Servlets, Life cycle of servlets, The servlet APIs, Writing Servlet Programs, Reading Form Parameters, Processing Forms, Handling HTTP Request and Response (GET / POST Request), Database Access with Servlets, Handling Cookies and Session. Servlet vs JSP, JSP Access Model, JSP Syntax (Directions, Declarations, Expression, Scriplets, Comments), JSP Implicit Objects, Object Scope, Processing Forms, Database Access with JSP. Java Web Frameworks, RMI and CORBA.

Text/Reference Books:

1. Programming with Java – A PRIMER by - E.Balagurusamy, Tata McGraw-Hill 3rd Edition
2. The Complete Reference - Java-2 by- Patrick Naughton and Herbert Schildt Published by Tata McGraw-Hill India.
3. The Complete Reference – J2EE by - Jim Keogh, published by Tata McGraw-Hill.
4. Advanced Java By Anuradha A. Puntambekar 2020
5. Advanced Java Programming By Uttam K. Roy 2015
6. Advanced Java Game Programming By David Wallace Croft 2013

WEB PROGRAMMING

2nd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA204 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of c language, XML, HTML.

Course Outcome:

- Define HTML and CSS syntax and semantics to build web pages.
- Understand the concepts of Construct, visually format tables and forms using HTML using CSS.
- Develop Client-Side Scripts using JavaScript and Server-Side Scripts using PHP to generate and display the contents dynamically.
- List the principles of object oriented development using PHP.
- Skill development and Employability: After completion of Multimedia and Web Technology course, the students will have web design skills and self-employability.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Web Programming, Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP, Security, the Web Programmers Toolbox, XHTML: Basic syntax, Standard structure, Basic text markup, Images, Hypertext Links. XHTML (continued): Lists, Tables, Forms, Frames CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The and tags, Conflict resolution.

UNIT-2

Overview of JavaScript, Object orientation and JavaScript, Syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructors, Pattern matching using regular expressions, Errors in scripts, Examples. The JavaScript execution environment, The Document Object Model, Element access in JavaScript, Events and event handling, handling events from the Body elements,

Button elements, Text box and Password elements, The DOM 2 event model, the navigator object, DOM tree traversal and modification

UNIT-3

Introduction to dynamic documents, Positioning elements, Moving elements, Element visibility, Changing colors and fonts, Dynamic content, Stacking elements, locating the mouse cursor, Reacting to a mouse click, slow movement of elements, Dragging and dropping elements, Introduction, Syntax, Document structure, Document type definitions, Namespaces, XML schemas, Displaying raw XML documents, Displaying XML documents with CSS, XSLT style sheets, XML processors, Web services.

UNIT-4

Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output; Examples. The Common Gateway Interface; CGI linkage; Query string format; CGI.pm module; A survey example; Cookies. Database access with Perl and MySQL. Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files, Cookies, Session tracking, Database access with PHP and MySQL.

Text/Reference Books:

1. PROGRAMMING THE WORLD WIDE WEB – Robert W Sebesta, 4th Edition, Pearson Education, 2008

ADVANCED JAVA AND NETWORKING LAB

2nd Semester - Hardcore course LTP:: 0:0:2	Total Credits:2 Lab Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAL21 Exam Hours: 3	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C language, algorithmic and problem solving skills.

Course Outcome: On the completion of this laboratory course, the students will be able to:

- Able to write programs for solving real world problems using java collection frame work.
- Able to write programs using abstract classes.
- The students should be able to write sophisticated Java applications. Upon completion of the course, the student will be able to use the Java language for writing well-organized, complex computer programs with both command- line and graphical user interfaces.
- Skill development and Employability: After completion of Java Lab, the students will have enhanced Algorithms skills to implement any software applications.

Course Content:

INSTRUCTION-1. Laboratory programs should be conducted as per the respective theory syllabus.

INSTRUCTION-2. Minimum 15 programs from PART- A and up to 10 Networking Programs from Part-B.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

WEB PROGRAMMING LAB

2nd Semester - Hardcore course LTP:: 0:0:2	Total Credits:2 Lab Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAL22 Exam Hours: 3	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C, XML language, algorithmic and problem solving skills.

Course Outcome: On the completion of this laboratory course, the students will be able to:

- Analyze a web page and identify its elements and attributes.
- Create web pages using XHTML and Cascading Style Sheets.
- Build dynamic web pages using JavaScript (Client side programming).
- Create XML documents and Schemas.
- Skill development and Employability: After completion of Web Programming Lab course, the students will have enhanced Front-end UI skills to implement any software applications.

Course Content:

INSTRUCTION-1: Laboratory programs should be conducted as per the respective theory syllabus.

INSTRUCTION-2: Minimum number of programs should be 15 in PART- A and a Mini project needs to be done in PART-B.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

INTERNET OF THINGS

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE21 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Must have a basic understanding of computing and the internet. This can include having a basic under- standing of programming languages such as C programming.

Course Outcome: On completion of this course, successful participants will be able to:

- Collect and analyze telemetry from connected sensors, devices, and equipment for real-time tracking, monitoring, management, and remote control.
- Understand the key technologies in IoTs, wireless sensor network architecture and its framework along with applications.
- Understand the resource management and business models for the IoT.
- Understand Design and development of IoT software's.
- Skill development and Employability: After completion of IoT course, the students will have enhanced carrier in IoT Design, development and Implementation.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

FUNDAMENTALS OF IoT: Evolution of Internet of Things - Enabling Technologies – IoT Architectures: oneM2M, IoT World Forum (IoTWF) and Alternative IoT models – Simplified IoT Architecture and Core IoT Functional Stack Fog, Edge and Cloud in IoT – Functional blocks of an IoT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects. Sensors: Light sensor, temperature sensor with thermistor, voltage sensor, ADC and DAC, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Wireless Bluetooth Sensors, Level Sensors, USB Sensors, Embedded Sensors, Distance Measurement with ultrasound sensor

UNIT-2

IoT PROTOCOLS: IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained

Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition –Application Layer Protocols: CoAP and MQTT. SECURING THE INTERNET OF THINGS: Security Requirements in IoT Architecture, Security in Enabling Technologies, and Security Concerns in IoT Applications.

UNIT-3

PRIVACY PRESERVATION FOR IoT: Privacy Preservation Data Dissemination, Privacy P- reservation for IoT Used in Smart Building, etc. DATA ANALYTICS AND SUPPORTING SERVICES: Structured Vs Unstructured Data and Data in Motion Vs Data in Rest – Role of Machine Learning – No SQL Databases – Hadoop Ecosystem – Apache Kafka, Apache Spark – Edge Streaming Analytics and Network Analytics– Xively Cloud for IoT, Python Web Application Framework – Django – AWS for IoT – System Management with NETCONF-YANG.

UNIT-4

DESIGN AND DEVELOPMENT: Design Methodology - Embedded computing logic - Microcontroller, System on Chips - IoT system building blocks - Arduino - Board details, IDE programming - Raspberry Pi - Interfaces and Raspberry Pi with Python Programming.

Text/Reference Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, — IoT Fun- damentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017.
2. Arshdeep Bahga, Vijay Madisetti, —Internet of Things – A hands-on approach, Universities Press, 2015 2. Olivier Hersent, David Boswarthick, Omar Elloumi, — The Internet of Things – Key applications and Protocols, Wiley, 2012
3. Jan Ho ller, Vlasios Tsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle,"From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelli- gence", Elsevier, 2014.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), — Architecting the Internet of Things, Springer, 2011.
5. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

6. IoT Security Advances in Authentication, Wiley,An Braeken, Madhusanka Liyanage, Mika Ylianttila, Pardeep Kumar, 2019
7. Security and Privacy in the Internet of Things: Challenges and Solutions, IOS Press, A. Skarmeta,J.L. Hern´andez Ramos 2020

ARTIFICIAL INTELLIGENCE

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE22 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- You must have a good catch on statistics, linear algebra, matrix, calculus, probability, programming languages and data modeling.

Course Outcome: On completion of this course, successful participants will be able to:

- AI can help businesses and organizations better understand customer behavior, market trends, and other important factors. This information can be used to make better decisions and improve business outcomes.
- Enhanced productivity, improved healthcare, and increased access to education. AI-powered technologies can also help solve complex problems and make our daily lives easier and more convenient.
- Skill Development and Employability: After completion of AI course, the students will have enhanced carrier in AI, development and Implementation of Automatic Systems.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

AI problems, foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, A* ,AO* Algorithms, Problem reduction, Game Playing- Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha- Beta pruning, Evaluation functions.

UNIT-2

Knowledge representation issues, predicate logic- logic programming, semantic nets-frames and inheritance, constraint propagation, representing knowledge using rules, rules based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences and dempster Shafer theory. First order logic. Inference in first order logic, propositional vs. first order inference, unification and lifts forward chaining, Backward chaining, Resolution, Learning from

observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning.

UNIT-3

Expert systems: Introduction, basic concepts, structure of expert systems, the human element in expert systems how expert systems works, problem areas addressed by expert systems, expert systems success factors, types of expert systems, expert systems and the internet interacts web, knowledge engineering, scope of knowledge, difficulties, in knowledge acquisition methods of knowledge acquisition, machine learning, intelligent agents, selecting an appropriate knowledge acquisition method, societal impacts reasoning in artificial intelligence, inference with rules, with frames: model based reasoning, case based reasoning, explanation and meta knowledge inference with uncertainty representing uncertainty.

UNIT-4

Explainable Artificial Intelligence (XAI):introduction and motivation, removal-based explanations, propagation-based explanations, evaluation metrics, inherently interpretable models, concept explanations, counter factual explanations, instance explanations, neuron interpretation. Human-AI collaboration. Applications in industry. Ensemble Learning: Introduction, Basic Ensemble Learning Techniques, Advanced Ensemble Learning, Techniques, Advanced Ensemble Learning: Bagging, Advanced Ensemble Learning: Boosting. Significance of Artificial Intelligence in Cyber Security, AI Conversational System – Attack Surface Areas and Effective Defense Techniques.

Text/Reference Books:

1. Better to not use a textbook because there isn't one that covers enough content (although Christoph Molnar's online (https://christophm.github.io/interpretable-ml-book/) book is quite good). Instead, we'll directly reference recent research papers.
2. S. Russel and P. Norvig,"Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education
3. David Poole, Alan Mackworth, Randy Goebel,"Computational Intelligence: a logical approach", Oxford University Press.
4. G. Luger,"Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education.
5. J. Nilsson,"Artificial Intelligence: A new Synthesis", Elsevier Publishers.

APPLIED CRYPTOGRAPHY AND NETWORK SECURITY

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE23 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- The main requirement is basic "Mathematical Maturity". Familiarity with Security, Linux, and Windows operating system.

Course Outcome:

- Understand cryptography and network security concepts and application
- Apply security principles to system design
- Identify and investigate network security threat
- Analyze and design network security protocols
- Conduct research in network security

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1:

Introduction: Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, CIA model. Block Ciphers (DES, AES): Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations.

UNIT-2:

Maths: Algorithmic number theory, number theory and cryptographic assumptions, Reductions, proofs by reductions, number theory candidates for cryptographic primitives (e.g., factoring and related problems). Public-Key Cryptography: Principles of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie- Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography.

UNIT 3:

Hash and MAC Algorithms: Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures. Key Management: Key Distribution Techniques, Kerberos.

UNIT 4:

Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME.

Text/Reference Books:

1. Cryptography and Network Security Principles and Practice Fourth Edition, William Stallings, Pearson Education
2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

DATA MINING AND DATA WAREHOUSING

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE24 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic understanding of Statistics, Database Knowledge, and Basic programming language.

Course Outcome: On completion of this course, successful participants will be able to:

- To understand data warehouse concepts, architecture, business analysis and tools
- To understand data pre-processing and data visualization techniques
- To study algorithms for finding hidden and interesting patterns in data
- To understand and apply various classification and clustering techniques using tools.
- Skill Development and Employability: After completion of Data Mining and Data Warehousing course, the students can choose carrier in Data Warehouse Engineering, Business Intelligence Engineering etc.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to data mining and Data Warehousing, Modeling: Data Cube and OLAP, Data Warehouse Implementation, Data Mining – types of data, types of patterns, Data cleaning, Data integration. Data Reduction, Wavelet Transforms, Attribute Subset Selection, Histogram, Clustering, Sampling, Data Cube Aggregation Data Transformation: Strategies Overview, Data Transformation by Normalization.

UNIT-2

Mining Frequent Patterns, Associations and Correlations: pattern evaluation methods. Classification, Decision tree Induction, Attribute Selection Measures, Tree Pruning, Bayes Classification Methods. Cluster Analysis: Requirement for Cluster Analysis, clustering methods Data Mining Applications and Trends: Mining Sequence Data; Time Series, Symbolic, Statistical Data Mining, Visual Data Mining, and Data Mining Applications.

UNIT-3

CLASSIFICATION AND CLUSTERING: Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines – Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods - Hierarchical Methods – Density Based Methods - Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

UNIT-4

Cloud-based data warehousing, Multimedia Data Mining, Green Data Warehousing, Data Warehousing AI Solutions, Virtual Data Warehousing, In-Memory Computing, In-Database Analytics, Data Compression, Analytics on Demand, Hadoop Integration, Simplified Data Warehousing for Marketing Agencies, Internet of things and data mining. WEKA TOOL: Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database - Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

Text/Reference Books:

1. Jiawei Micheline Kamber, 'Data Mining Concepts and Techniques', Morgan Kauf Mann Publishers
2. George M. Marakas, 'Modern Data Warehousing, Mining and Visualization', Pearson Education, 2003.
3. W.H. Inmon, 'Building the Data Warehouse', Wiley dreamtech, 3rd Edition.
4. Mastering Data Mining – Michael J.A. Berry and Gordon S. Linoff (Wiley Pub.).
5. Data Warehousing (Pearson Ed.) – Sam Anahory and Dennis Murray.
6. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression, 2014.
7. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.

DESIGN THINKING

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE25 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic understanding of computer and programming language.

Course Outcome: On completion of this course, successful participants will be able to:

- Understand the concepts of design thinking approaches
- Create design thinking teams and conduct design thinking sessions
- Apply both critical thinking and design thinking in parallel to solve problems
- Apply some design thinking concepts to their daily work
- Skill Development and Employability: After completion of Design Thinking course, the students can inculcate Design Thinking.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Design Thinking Overview: What Is Different About Design thinking?, Design Thinking in the Workplace, Design Thinking Skills, Design Thinking Mindset, Principles of Design Think- ing, General Approaches to Design Thinking, The Basis for Design Thinking, Design Thinking Frameworks, The Design Thinking Team, What Constitutes a Design Thinking Team?, Design Thinking Workshops and Meetings, Characteristics, Types of Workshops.

UNIT-2

A Design Thinking Approach in Stages, Apply the Design Thinking Frameworks, Empathize with the Customers and/or Users, Define the Problem, Define the Point of View Ideate, Develop Potential Solutions, Feedback on the Solutions, Prototype Alternate Solutions , Create a Pro- to type of the Solution, Review the Prototype and Gain Feedback, Test the Solutions, Prepare Test of the Prototype and Solution.

UNIT-3

Design Thinking Techniques , Listening and Empathizing Techniques: Engagement, Observation, Showing Empathy, Define and Ideation Techniques, Unpacking, Unpack to the Wall, Personas, Create Personas for the Case Study, Pattern Recognition and Connecting the Dots, Prototype and Test Techniques, Types of Prototypes, Revise Franken Prototype to Refined Prototype, Forms of Testing in Design Thinking, Prepare and A / B Test of the Prototype

UNIT-4

General Design Thinking Practices: Visualization Techniques and Diagrams, Use of Diagrams and Maps in Design Thinking , Create an Empathy Map, Revisit the Wall, Create an Affinity Diagram, Create a Mind Map, Create a Journey Map, Story Telling Techniques, Story Telling Throughout the Design Thinking Process, Improvisation, Tell a Story, Scenarios, Create a Set of Scenarios for the Case Study- K-Scripts, Create a Set of K-Scripts for the Case Study, Perform Role Playing of Scenarios for the Case Study, Adopt and Adapt Design Thinking, Cautions and Pitfalls, Assumptions, Pitfalls and Cautions in Design Thinking Workgroups, Final Words and Best Practices, Best Practices, Take the Practices Back to the Office.

Text/Reference Books:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires
2. Innovation, HarperCollins Publishers Ltd.
3. IdrisMootee, Design Thinking for Strategic Innovation, 2013, John Wiley and Sons Inc
4. Brenda Laurel Design Research methods and perspectives MIT press 2003
5. Terwiesch, C. and Ulrich, K.T., 2009. Innovation Tournaments: creating and identifying Exceptional Opportunities, Harvard business press.
6. Ulrich and Eppinger, Product Design and Development, 3rd Edition, McGraw Hill, 2004

BIO-INFORMATICS

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE26 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Computer Science, Information Theory and Biology.

Course Outcome: On completion of this course, successful participants will be able to:

- The fundamental objectives are to identify genes and proteins, determine their functions, establish evolutionary relationships and predict their conformation.
- Bioinformatics is used to analyze and interpret biological data, develop computer programs to efficiently access, manage, and use biological information and create mathematical formulas and statistical approaches to evaluate relationships in large datasets.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Bio-Informatics, Algorithms and Complexity, Molecular Biology Primer

UNIT-2

Exhaustive Search, Greedy Algorithms, Dynamic Programming Algorithms

UNIT-3

Divide-and-Conquer Algorithms, Graph Algorithms, Combinatorial Pattern Matching

UNIT-4

Clustering and Trees, Hidden Markov Models, Randomized Algorithms

Text/Reference Books:

1. An Introduction to Bioinformatics Algorithms by Neil C. Jones and Pavel A. Pevzner, MIT Press 2004,ISBN-0262101068

THEORY OF COMPUTATION

2nd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE27 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic knowledge on Mathematics, Logics.

Course Outcome:

- To use basic concepts of formal languages of finite automata techniques
- To Design Finite Automata's for different Regular Expressions and Languages
- To Construct context free grammar for various languages
- To solve various problems of applying normal form techniques, push down automata and Turing Machines
- To participate in GATE, PGECET and other competitive examinations

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

FINITE AUTOMATA (FA): Introduction, Deterministic Finite Automata (DFA) -Formal definition, simpler notations (state transition diagram, transition table), language of a DFA. Non-deterministic Finite Automata (NFA)- Definition of NFA, language of an NFA, Equivalence of Deterministic and Nondeterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT-2

REGULAR EXPRESSIONS (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions- Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions. REGULAR GRAMMARS: Definition, regular grammars and FA, FA for regular grammar, Regular grammar for FA. Proving languages to be non-regular -Pumping lemma, applications, and Closure properties of regular languages.

UNIT-3

CONTEXTFREE GRAMMER (CFG): Derivation Trees, Sentential Forms, Rightmost and Leftmost derivations of Strings. Ambiguity in CFG's, Minimization of CFG's, CNF, GNF, Pumping Lemma for CFL's, Enumeration of Properties of CFL (Proof's omitted). PUSH- DOWN AUTOMATA: Definition, Model, Acceptance of CFL, Acceptance by Final State and Acceptance by Empty stack and its Equivalence, Equivalence of CFG and PDA. TURING MA- CHINES (TM): Formal definition and behavior, Languages of a TM, TM as accepters,

UNIT-4

RECURSIVE AND RECURSIVELY ENUMERABLE LANGUAGES (REL): Properties of recursive and recursively enumerable languages, Universal Turing machine, The Halting problem, Undecidable problems about TMs. Context sensitive language and linear bounded automata (LBA), Chomsky hierarchy, Decidability, Post's correspondence problem (PCP), un-decidability of PCP.

Text/Reference Books:

2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman (2007), Introduction to Automata Theory Languages andComputation, 3rdedition, Pearson Education, India.
3. K. L. P Mishra, N. Chandrashekaran (2003), Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.

PYTHON PROGRAMMING

3rd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA301 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic Knowledge of C Programming, OOPs Concepts.

Course Outcome:

- Describe the semantics of Python programming language and illustrate the process of structuring the data using lists, dictionaries, tuples, strings and sets.
- Illustrate the Object-oriented Programming concepts in Python.
- Demonstrate the basic database design for storing data as part of a multi-step data gathering, analysis, and processing.
- Familiarize the basics of machine learning using an approachable, and also understand the advantage of using Python libraries for implementing Machine Learning models.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Python, use IDLE to develop programs, Basic coding skills, working with data types and variables, working with numeric data, working with string data, Python functions, Boolean expressions, selection structure, iteration structure, working with lists, work with a list of lists, work with tuples, work with dates and times, get started with dictionaries.

UNIT-2

Classes in Python: OOPS Concepts, Classes and objects , Classes in Python, Constructors, Da- ta hiding, Creating Classes, Instance Methods, Special Methods, Class Variables, Inheritance, Polymorphism, Type Identification, Custom Exception Classes, Iterators, generators and dec- orators. I/O and Error Handling In Python :Introduction, Data Streams, Creating Your Own Data Streams, Access Modes, Writing Data to a File, Reading Data From a File, Additional File Methods, Handling IO Exceptions, Errors, Run Time Errors, The Exception Model, Exception Hierarchy, Handling Multiple Exceptions, Working with Directories.

UNIT-3

An Introduction to relational databases: SQL statements for data manipulation, Using SQLite Manager to work with a database, Using Python to work with a database, creating a GUI that handles an event, working with components. Implement Machine Learning algorithms: Usage of Numpy for numerical Data, Usage of Pandas for Data Analysis, Matplotlib for Python plotting, Seaborn for Statical plots, interactive Dynamic visualizations, SciKit for Machine learning.

UNIT-4.

Advanced Topics: Network Programming, SMTP, Magic Functions, Decorators, Descriptors, date and time, Regular Expression, Threads, Accessing API, DJango

Text/Reference Books:

1. Michael Urban and Joel Murach, Python Programming, Shroff/Murach, 2016
2. Haltermanpython
3. Mark Lutz, Programming Python, O'Reilly, 4th Edition, 2010
4. ONLINE RESOURCES:
    1. https://www.w3schools.com/python
    2. https://docs.python.org/3/tutorial/index.html
    3. https://www.python-course.eu/advanced_topics.php

MACHINE LEARNING

3rd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA302 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basics of Algebra, Linear algebra, Trigonometry, Statistics, Calculus, Python Programming.

Course Outcome:

- Gain knowledge about basic concepts of Machine Learning.
- Identify machine learning techniques suitable for a given problem.
- Solve the problems using various machine learning techniques
- Design and implement machine learning solutions to classification, regression, and clustering problems; and be able to evaluate and interpret the results of the algorithms.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1.

Introduction, Machine learning definition, importance of machine learning, machine learning framework, types of machine learning, relation to other fields, examples of machine learning applications, designing a learning system, issues in machine learning.

UNIT-2.

Introduction to Supervised Learning, Decision tree based classifier, Bayesian theory based classifier, and neural network based classifier, nearest neighbor classifier, Support vector classifier, performance evaluation.

UNIT-3.

Introduction to Unsupervised Learning, Clustering methods, Criteria functions for clustering, Similarity measures, Component analysis, Low dimensional analysis and multidimensional scaling.

UNIT-4.

Additional topics, Reinforcement learning, Genetic algorithms, Analytical learning, Ensemble of classifiers, Design and analysis of machine learning experiments

Text/Reference Books:

1. Machine Learning: a Probabilistic Perspective by Kevin Patrick Murphy, MIT Press, March 2014.
2. Introduction to Machine Learning by Alex Smola and S.V.N. Vishwanathan, Cambridge University Press.
3. Understanding Machine Learning: From Theory to Algorithms by Shai Shalev-Shwartz and Shai Ben-David
4. Published 2014 by Cambridge University Press.

BIG DATA ANALYTICS

3rd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA303 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basic understanding of Core Java and SQL.

Course Outcome:

- Understand the key issues in big data management and its associated applications in intelligent business and scientific computing.
- Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics
- Interpret business models and scientific computing paradigms, and apply software tools for big data analytics.
- Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Overview of Big Data: History of big data, its elements, career related knowledge, advantages, disadvantages. Using Big Data in Businesses: Focus on the application perspective of Big Data covering, using big data in marketing, analytics, retail, hospitality, consumer good, defense etc. Technologies for Handling Big Data: Introduction to Hadoop, functioning of Hadoop, Cloud computing (features, advantages, applications) etc.

UNIT-2

Understanding Hadoop Ecosystem: Hadoop and its ecosystem which includes HDFS, Map Re-duce, YARN, HBase, Hive, Pig, Sqoop, Zookeeper, Flume, Oozie etc,. Dig Deep to understand the fundamental of Map Reduce and HBase: framework of Map Reduce and uses of map re- duce. Understanding Big Data Technology Foundations: big data stack i.e. data source layer, ingestion layer, source layer, security layer, visualization layer, visualization approaches etc.

UNIT-3

Databases And Data Warehouses: Databases, polygot persistence and their related introductory knowledge. Using Hadoop to store data: Module of HDFS, HBase and ways to store and manage data along with their commands. Learn to Process Data using Map Reduce: Emphasizes on developing simple map reduce framework and the concept applied.

UNIT-4

Testing and Debugging Map Reduce Applications: Learn Hadoop YARN Architecture: back-ground of YARN, advantages of YARN, working with YARN, backward compatibility with YARN, YARN Commands, log management etc. Exploring Hive, Exploring PIG, Exploring Oozie, Learn NoSQL Data Management: NoSQL including document databases, relationships, graph databases, schema less databases, CAP Theorem etc. Integrating R and Hadoop and Understanding Hive in Detail.

Text/Reference Books:

1. Big Data Now: 2014 Edition by"Raymond I Morrison"
2. Analytics in a Big Data World: The essential guide to data science and its application
3. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data by EMC Education Services, 2015, publishing.
4. Anand Raja Raman and Jeffrey David Ullman, Mining of Massive Datasets, 2012, Cambridge Uni- versity Press.
5. Tom White, Hadoop: The Definitive Guide, 3rd Edition, O'Reilly Media

SOFTWARE ENGINEERING

3rd Semester - Hardcore course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA304 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Aware Planning, Requirement Analysis, Design, Implementation/Coding, Testing, Deployment, Maintenance.

Course Outcome:

- Identify unique features of various software application domains and classify software applications.
- Choose and apply appropriate lifecycle model of software development.
- Identify user needs and formulate software specifications, analyze requirements by applying various modeling techniques, Translate the requirements model into the design model.
- Understand the importance of User-interface design principles in software development, the conceptsof clean room software development.
- Classify CASE tools and their applicability in software development.
- Understand the principles of agile development and distinguish agile process model from other processmodels.
- Learn the emerging trends in software development.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction: Need for software engineering, the role of software engineering in system design, software products, software processes, and characteristics of software process, the software life cycle, software development process models, and comparison of process models. Software Requirement Specifications and analysis (SRS and SRA).

UNIT-2

Software Design: Introduction, software design approaches, design principles, module level concepts, Function-oriented software design, Object-oriented software design concepts. Cohesion and coupling. Coding and Testing, types of testing, Debugging, approaches and guidelines, program analysis tools, integration testing, system testing, general issues associated with testing.

UNIT-3

Software Project Management (SPM): Responsibility of software project managers, project planning, structure of software project management document, project size estimation metrics, project scheduling and staffing, work break down structure, Gantt charts, PERT charts, organization and team structures, attributes of a good software engineer, risk management and configuration management, software maintenance process models, estimation of maintenance costs, Software Quality Management.

UNIT-4

Emerging Technologies: Agile software development concepts, Security concepts, security risk management, design for security, system survivability. Service-oriented software engineering-services as reusable components, service engineering, software development with services. Aspect-oriented software development- The separation of concerns, aspects, software engineering with aspects.

Text/Reference Books:

1. Software Engineering, Ian Sommerville, 8th Edition, Pearson Education Ltd.,
2. Software Engineering – A practitioners approach, Roger. S. Pressman, Tata-McGraw Hill 6th Edition.
3. Fundamentals of software engineering, Rajib Mall, Phi learning Pvt. Ltd, 3rd edition.
4. Pankaj Jalote – An Integrated Approach to Software Engineering, Third Edition.
5. Ghezzi, Jazayeri, Mandrioli – Fundamentals of Software Engineering, PHI.

MACHINE LEARNING USING PYTHON LAB

3rd Semester - Hardcore course LTP:: 0:0:2	Total Credits:2 Lab Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAL31 Exam Hours: 3	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C and problem solving skills.

Course Outcome: On the completion of this laboratory course, the students will be able to:

- Understand Python and identify its features.
- Programming in Python.
- Problem solving using Python.
- Skill development and Employability: After completion of Python Programming Lab course, the students will have enhanced server-end skills to implement any software applications.

Course Content:

INSTRUCTION-1. Laboratory programs should be conducted as per the respective theory syllabus.
INSTRUCTION-2. Minimum 10 programs from PART- A and a Mini Project in Part-B needs to be executed.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

BIG DATA ANALYTICS LAB

3rd Semester - Hardcore course LTP:: 0:0:2	Total Credits:2 Lab Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAL32 Exam Hours: 3	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Fundamental computer knowledge that includes concepts of C, Python and problem solving skills.

Course Outcome: On the completion of this laboratory course, the students will be able to:

- Understand Big Data Analytics Concepts and Algorithms.
- Hadoop Application Programming
- Big Data Analytics Problem solving using Java/Python/R/OOPs.
- Skill development and Employability: After completion of Big Data Analytics Lab course, the students Tools knowledge of Big Data Analytics to implement any Big Data software applications.

Course Content:

INSTRUCTION-1. Laboratory programs should be conducted as per the respective theory syllabus.

INSTRUCTION-2. Minimum number of programs should be 30 among that 15 programs from PART-A to have basic programs and other 15 programs from PART-B to have extended or enhanced programs.

Text/Reference Books:

1. Refer respective theory's Text/Reference books.

MEAN AND MERN WEB DEVELOPMENT

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE31 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Basics of basics of HTML, CSS, and JavaScript.

Course Outcome:

- Both MEAN and MERN stacks offer excellent scalability, flexibility, and third-party support, making them suitable for building large-scale web applications.
- MEAN is more popular for enterprise-level architecture, while MERN is more popular for smaller applications.
- MEAN is often preferred for enterprise-level architecture, while the MERN stack is prevalent for smaller applications.
- Both MERN and MEAN stacks offer a flexible and scalable solution for web development.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

What is MEAN Stack Web Development? Node JS : Introduction to Nodejs, A word on event-loop, Event driven architecture, Blocking vs non-blocking code , Setup nodejs, Node REPL, HelloWorld program, Debugging nodejs app.Data visualization: Understanding exports and re-quire, Creating modules, Importing modules,npm. Events and streams: Significance of Events, EventEmitter class, Emitting and listening to events, Types of streams, working with streams, composing streams using pipe. Express JS: Expressjs Introduction and Setup, Installing ex- press, First App with express - Demo, Little about routes, Little about Express middleware, Serving static files with express, Express application generator, What is expressjs. Routing in Depth: Route Methods, Parametrized Routes, Express Router, Template Engines, Expressjs security-Authentication ,JWT, Securing routes, Debugging in Express, Realtime programming with Socket.io, Scaling nodejs applications-The Child process model, exec, spawn, and fork functions, Using the Cluster module.

UNIT-2

Mongo DB: Introduction to MongoDB-Installing MongoDB, The current SQL/NoSQL landscape, Document-oriented vs. other types of storage, Mongo's featureset, Common use-cases, MongoDB databases, MongoDB Collections, MongoDB Documents. CRUD Operations in Mongodb-Creating documents, insert, update, save. Querying documents-find, working with equality, Query operators, Building complex queries, Updating documents, Deleting documents. Introduction to Mongoose-Word on ORM/ODM, Installing mongoose, connecting to MongoDB from mongoose. Core concepts of Mongoose-Understanding mongoose schemas and datatypes, Working with Models, Using modifiers in schema, Using virtual fields, Optimizing query performance by enabling indexes. Extending Models- Working with hooks, Validation of model data, creating custom static methods, creating custom instance methods, CRUD operations with Mongoose.

UNIT-3

Angular JS: Typescript Setup and installation, Power of Types, Explore Functions- Using types in functions, function as types, Optional and default parameters, Arrow functions, Function overloading. Classes, Interfaces, Modules. What is MERN Stack Development? MEAN Stack Benefits, MERN Stack Benefits, and The Difference between MEAN Stack vs MERN Stack, Comparison: Full Stack vs MERN Stack vs MEAN Stack, Which Stack Should You Choose for Your Next Project? Introduction to HTML and CSS, GIT and Responsive Design, Advanced CSS Techniques and Best Practices, JavaScript and ES6 Essentials, JavaScript Fundamentals and DOM Manipulation.

UNIT-4

Introduction to React and JSX, React Components, Props and Conditional Rendering, React States and Hooks, React Routing and Types of Routers, Class-Based Components, React Lifecycle and Context. Introduction to Node.js and Express.js, Building RESTful APIs with Node and Express.js, Introduction to MongoDB and Mongoose, MongoDB Indexing, Aggregation and Security, Node.js Advanced Concepts and Authentication

Text/Reference Books:

1. MEAN Web Development by Amos Haviv Q., Amos Q. Haviv 2016
2. Pro MERN Stack Full Stack Web App Development with Mongo, Express, React, and Node by Vasan Subramanian 2019
3. Getting MEAN with Mongo, Express, Angular, and Node by Simon Holmes, clive harber 2019
4. MERN Quick Start Guide Build Web Applications with MongoDB, Express.js, React, and Node by Eddy Wilson 2018
5. Full-Stack React Projects, Learn MERN Stack Development by Building Modern Web Apps Using MongoDB, Express, React, and Node.js, 2nd Edition by Shama Hoque 2020

BLOCKCHAIN TECHNOLOGY

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE32 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- A solid understanding of computer science, information technology, and information security. The knowledge of distributed systems, networking, cryptography, and data structures is essential for aspiring block chain developers.

Course Outcome:

- Understand block chain technology and key concepts such as cryptography and crypto currency concepts get a deeper understanding of Bit coin and its network.
- Understand what distributed ledger and hyper ledger means Architect and develop applications on Ethereum Block chain.
- Learn about consensus, transactions, work flows, and networks Get hands-on experience with a capstone on industry-relevant use cases. Understand and learn about smart contracts.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Fundamentals of Blockchain: Introduction to Blockchain, Challenges Faced by Modern Businesses what is Blockchain? Building Blocks of Blockchain, Types of Blockchain.

UNIT-2

Blockchain Pillars, Bitcoin Blockchain, Ethereum Blockchain, Enterprises Blockchain.

UNIT-3

Blockchain Applications and Architecture: Ethereum Smart Contracts.

UNIT-4

Hyperledger Fabric Chaincode, Hyperledger Fabric SDK, Multichain.

Text/Reference Books:

1. Handbook of Research on Blockchain Technology 2020, Elsevier Science
2. Blockchain Technology: Applications and Challenges 2021, Springer International Publishing
3. Blockchain Technology for Emerging Applications a Comprehensive Approach 2022
4. Blockchain Blueprint for a New Economy by Melanie Swan 2015

MOBILE APPLICATION DESIGN AND DEVELOPMENT

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE33 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Java and XML.

Course Outcome:

- Identify various concepts of mobile programming that make it unique from programming for other platforms.
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- Program mobile applications for the Android operating system that use basic and advanced phone features, and Deploy applications to the Android marketplace for distribution.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android Installation, Building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT-2

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.

UNIT-3

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT-4

Using Common Android APIs: Using Android Data and Storage APIs, Managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Text/Reference Books:

1. Lauren Darcey and Shane Conder,"Android Wireless Application Development", Pearson Education, 2nd ed. (2011)
2. Reto Meier,"Professional Android 2 Application Development", Wiley India Pvt Ltd
3. Mark L Murphy,"Beginning Android", Wiley India Pvt Ltd
4. Android Application Development All in one for Dummies by Barry Burd, Edition: I

DEVOPS

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE4 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Have experience in both software development and system administration. Knowledge on scripting language (such as Python or Ruby) and a configuration management tool (such as Puppet or Chef).

Course Outcome:

- Learn why automation, culture, and metrics are essential to a successful DevOps project.
- Learn how DevOps can positively impact your business's bottom line.
- Learn utilizing DevOps in engineering processes.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to Devops: DevOps and Software Development Life Cycle, Waterfall Model , Agile Model, Continuous Integration and Deployment, Jenkins, Containers and Virtual Development, Docker, Vagrant, Configuration Management Tools. Cloud Computing: IAAS, SAAS, PAAS, Private, Public and Hybrid Cloud, Public Clouds. LINUX Basic and Admin: Importance of Linux in DevOps, Linux Administration, Environment Variables, Networking, Linux Server Installation, RPM and YUM Installation. Shell Scripting: Introduction, Variables, Flow Controls, Loops, Functions, Lists, Manipulating Strings, Reading and Writing Files, Positional Parameters.

UNIT-2

Continuous Integration – Jenkins: Introduction to Jenkins, Continuous Integration with Jenkins, Configure Jenkins, Jenkins Management, Scheduling build Jobs, POLL SCM, Build Periodically, Maven Build Scripts , Support for the GIT version control System, Different types of Jenkins Jobs, Jenkins Build Pipe Line , Parent and Child Builds, Sequential Builds, Jenkins Master and Slave Node Configuration, Jenkins Workspace Management, Securing Jenkins, Installing Jenkins Plugins.

UNIT-3

Version Control-GIT: GIT Features, 3-Tree Architecture , Clone /Commit / Push, Hub Management, Rebase and Merge ,Stash, Reset, Checkout, Clone, Fetch, Pull. Build tool- Maven: Maven Installation, Build requirements, POM Builds (pom.xml), Local Repository (.m2), Global Repository, Group ID, Artifact ID, Snapshot, Dependencies, and Plugins.

UNIT-4

ANSIBLE: Introduction to Ansible, Server Configuration, Infrastructure Management, SSH Connection in Ansible Master, YAML Scripts, Host Inventory, Hosts and Groups, Variables, Ad-hoc Commands, Conditionals, Loops, Blocks, Handlers, Templates. Docker: Docker Image, Docker Installation, Container Docker Engine, Command Line Interphase, Compose, Hub , Trusted Registry, swarm, attach File and Commands.

Text/Reference Books:

1. DevOps: A Complete Beginner's Guide to DevOps, Jim Lewis, 2019
2. Effective DevOps - Building a Culture of Collaboration, Jennifer Davis, Ryn Daniels, 2016
3. Python for DevOps-Learn Ruthlessly Effective Automation, Noah Gift, Kennedy Behrman, Alfredo Deza, 2019
4. Learning DevOps-The complete guide to accelerate, Mikael Krief, 2019

INTRODUCTION TO NLP AND CHATGPT

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE35 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Strong programming skills, particularly in Python. Since computational methods are used in NLP, it becomes obvious that you must know graduation-level mathematics. Ability to code in one of the popular programming languages like C/C++, Python, R, Java.

Course Outcome:

- Learn OpenAI and API
- chatGPT and Usages
- NLP Concepts

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Foundations of NLP: Concepts, Techniques, And Tools: Introduction to NLP - Basics, Applications and Future Scope working with web data - Collection, Inspection and Scrapping Data Preprocessing. Basic applications of NLP: Build your own ML Model for Media Sentiment Analysis - Media Data Analysis Working with highly unstructured data - Scrapping, Noise Removal and Pattern Matching.

UNIT-2

NLP Feature Engineering and Modelling: Feature Engineering - NLP Pipeline, Text Vectorization - BOW, n-gram, TF-IDF Implementation of ML algorithms in NLP - Clustering, Topic Modelling, Sentiment Analysis. Advanced Applications of NLP: Building ML model for NLP- News Data Analysis, Introduction to Advanced NLP Tools - Word Embedding and Deep Learning in NLP. B. Sentiment Analysis and Synthesis, etc.

UNIT-3

OpenAI: Introduction to large language model-based Chabot, Introduction to ChatGPT, How does ChatGPT work? Embedding's Fine-tuning, Building a Simple Application Powered by ChatGPT: Interfacing with ChatGPT API, Creating a new Node.js application, creating a book

recommendation app using ChatGPT API, Creating a web front end. Microsoft to build human-machine interactions with natural language AI, integrating ChatGPT into its products and tools.

UNIT-4

ChatGPT (Chat Generative Pre-trained Transformer) for Generating codes and Generating documents: What types of coding can ChatGPT do well? How to use ChatGPT to create an app? ChatGPT to provide sources and citations. ChatGPT for writing test cases using Jest. Simplifying codes and explaining complex code snippets. Limitations of ChatGPT, ChatGPT Alternatives: Bloom, Replika, Jasper, FaceApp, etc.

Text/Reference Books:

1. Speech and Language Processing, Dan Jurafsky 2000
2. NLP: The Essential Guide to Neuro-Linguistic Programming, Tom Hoobyar, Tom Dotz, Susan Sanders 2013
3. Mastering ChatGPT: A Comprehensive Guide to Prompt Engineering, Coding, and Monetization Unleash the Full Potential of ChatGPT: Expert Strategies for Prompt Engineering, Coding Mastery, and Lucrative Monetization by Balaji murumbe 2023.
4. The Chatbot Revolution ChatGPT: An In-Depth Exploration by David Franklin 2022
5. Mastering ChatGPT Unlocking the Full Potential of Large Language Models by Mostafa Gamil, ChatGPT 2023
6. The Power of ChatGPT Leveraging the Potential of AI in Social Media. By Kp Panchal 2023

HYPER AUTOMATION

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE36 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Artificial Intelligence (AI), Machine Learning (ML) and Robotics, etc.

Course Outcome:

- Assess hyper automation approaches based on mega trends and data configuration
- Design data acquisition types and methods to populate CMDB with enterprise level tools
- Formulate possible machine learning solutions for different problems
- Evaluate performance of machine learning models
- Create table structures, workflow, and front-end scripts to meet automation needs with enterprise grade tools
- Construct scripted workflows for automation with enterprise grade tools

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Introduction to hyper automation, Megatrends in hyper automation and robotics, Introduction to Software-as-a-Service

UNIT-2

Essentials of Configuration Management Database (CMDB), Introduction to robotic process automation (RPA), Use of optical character recognition (OCR) capabilities

UNIT-3

Essential Python programming, Python debugging and logging best practices, Introduction to artificial intelligence and neural networks

UNIT-4

Essential mathematics for neural networks, Implementing neural networks and machine learning, Evaluating machine learning models

Text/Reference Books:

1. Hyper automation By Matt Calkins, Neil Ward-Dutton, George Westerman, Lakshmi N, Sidney Fernandes, Alice Wei, Chris Skinner, Isaac Sacolick, John Rymer, Lisa Heneghan, Darren Blake, Rob Galbraith, Ron Tolido, Michael Beckley 2020
2. Hyper automation a Complete Guide - 2020 Gerardus Blokdyk
3. Hyper automation: Introducing an IBPMS to Optimize Business Marlena Fischer 2021
4. INTELLIGENT AUTOMATION Learn how to harness Artificial Intelligence to boost business and make our world more human By Ian Barkin, Pascal Bornet, Jochen Wirtz 2020

RESEARCH METHODOLOGY

3rd Semester - Elective course LTP:: 4:0:0	Total Credits:4 Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAE37 Exam Hours: 3	Total Marks: 100 Semester End Exam:70 Continuous Internal Evaluation:30

Course Prerequisite:

- Critical Thinking.

Course Outcome:

- Demonstrate the ability to choose methods appropriate to research aims and objectives.
- Understand the limitations of particular research methods.
- Develop skills in qualitative and quantitative data analysis and presentation.
- Develop advanced critical thinking skills.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 52)

UNIT-1

Foundations of Research: Meaning, Objectives, Motivation, Utility. Concept of theory, empiricism, deductive and inductive theory. Characteristics of scientific method – Understanding the language of research – Concept, Construct, Definition, Variable. Research Process. Problem Identification and Formulation – Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis and Alternative Hypothesis. Hypothesis Testing – Logic and Importance.

UNIT-2

Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent and Dependent variables. Qualitative and Quantitative Research: Qualitative research – Quantitative research – Concept of measurement, causality, generalization, replication. Merging the two approaches.

UNIT-3

Measurement: Concept of measurement– what is measured? Problems in measurement in re- search – Validity and Reliability. Levels of measurement – Nominal, Ordinal, Interval, Ratio. Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample,

Systematic Sample, Stratified Random Sample and Multi-stage sampling. Determining size of the sample – Practical considerations in sampling and sample size.

UNIT-4

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association. Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish ? Ethical issues related to publishing, Plagiarism and Self-Plagiarism. Software for paper formatting like LaTeX/MS Office, Software for detection of Plagiarism

Text/Reference Books:

1. Business Research Methods – Donald Cooper and Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman and Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Select references from the Internet

MAJOR PROJECT

4th Semester - Hardcore course LTP::0:4:12	Total Credits:16 Tutorial Class Hours: 4 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA4014 Exam Hours: 3	Total Marks: 200 Semester End Exam:160 Continuous Internal Evaluation:40

Course Prerequisite:

- Coding, OOPs Languages, Web tools, MVC/MVT architecture, Client-Server Model etc.
- Course Outcome:
- Project on current Trends
- Develop deep content knowledge as well as skills like critical thinking, collaboration, creativity, and communication.
- Problem solving, Algorithms, Bug fixing etc.
- Able to identify and formulate the real time problem (application development or research related) by extensively studying the recent literature and identifying the research or application gap.
- Understand and get the practical exposure to the tools and technology needed to implement the solution to the problem defined.
- Critically evaluate the performance of the application/algorithm designed by conducting extensive experiments on various test cases and comparing the results with the state-of-the art application- s/algorithms.
- Able to learn how to precisely document the dissertation work carried out using the various documenting and diagrammatic tools.

Project Guidelines:

1. The Project topics should be based on syllabus or as per the requirement of specific industry in sync with the course. Every student has to prepare and submit the project work separately. Plagiarism would not be accepted under any circumstances.
2. Project Report should compulsorily include the software development, soft copy should also be submitted in CD along with Hard Bound Project report.
3. All students must submit a summary/abstract separately with the project report. Summary, preferably, should be of about 3-4 pages. The content should be as brief as is sufficient to explain the objective and implementation of the project that the candidate is going to take up. The write up must adhere to the guidelines and should include the following:

- Name / Title of the Project q Statement about the Problem
- Why is the particular topic chosen?
- Objective and scope of the Project
- Methodology (including a summary of the project)
- Hardware and Software to be used
- Testing Technologies used
- What contribution would the project make?

4. **TOPIC OF THE PROJECT**- This should be explicitly mentioned at the beginning of the Synopsis. This being the overall impression on the future work, the topic should be able to corroborate the work.

5. **OBJECTIVE AND SCOPE**: This should give a clear picture of the project. Objective should be clearly specified. What the project ends up to and in what way this is going to help the end user has to be mentioned.

6. **PROCESS DESCRIPTION:** The process of the whole software system proposed, to be developed, should be mentioned in brief. This may be supported by DFDs / Flowcharts to explain the flow of the information.

7. **RESOURCES AND LIMITATIONS**: The requirement of the resources for designing and developing the proposed system must be given. The resources might be in form of the hardware/software or the data from the industry. The limitation of the proposed system in respect of a larger and comprehensive system must be given.

8. **CONCLUSION**: The write-up must end with the concluding remarks-briefly describing innovation in the approach for implementing the Project, main achievements and any other important feature that makes the system stand out from the rest.

9. **Final Project Report**: Good quality white executive bond paper A4 size should be used for typing. Care should be taken to avoid smudging while creating the copies.

10. **Page Specification** :(Written paper and source code) Left margin - 3.0 cms 3 Right margin- 2.0 cms Top margin 2.54 cms Bottom margin 2.54 cms Page numbers - All text pages as well as Program source code listing should be numbered at the bottom center of the pages.

11. Normal Body Text: Font Size: 12, Times New Roman, Double Spacing, Justified. 6 point above and below para spacing

12. Paragraph Heading Font Size: 14, Times New Roman, Underlined, Left Aligned. 12 point above and below spacing.

13. Chapter Heading Font Size: 20, Times New Roman, Centre Aligned, 30 point above and below spacing. Coding Font size: 10, Courier New, Normal

14. Binding and Color code of the report/Thesis: For MCA – VI Semester (Project work) required Hard Bound Report including Certificate of Originality from the Supervisor/Guide.

Background of the Cover Page of Book should be Black and Letters in Black.

15. **Submission**: Hard Bound Copy of Project report along with the Software (in CD) should be sub- mitted to the Department within a prescribed schedule with all signatures including Student, Guide, and Chairman.

Project Evaluation Guidelines in Exam:

The project will be evaluated based on the following criteria's:

- Presentation - 25% of total marks
- Viva - 20% of total marks.
- Thesis/Project report - 30% of total marks.
- Software Coding: Documentation - 10% of total marks.
- Software (Final Results/Outputs) - 15% of total marks.

Text/Reference Books:

1. Recent literature available in various portals/websites.
2. Books/Manuals related to the problem domain and implementation platform.
3. Research articles published in various journals and conferences.

SEMINAR

4th Semester - Hardcore Component LTP:: 2:0:0	Total Credits:2 Hours: 2 hrs./week
Programme: Master of Computer Applications Course Code: :23MCA403	Total Marks: 50 Semester End Exam: 50 **(Internal Examination-Presentation)** Continuous Internal Evaluation: NA

Course Prerequisite:

- Technical knowledge on Computer Science Subjects.

Course Outcome:

- On the completion of this course, the students will be able to:
- Stage Courage and face the public with rich content.
- Learn how technical subjects/topics can be delivered to the audience.

Seminar Guidelines:

INSTRUCTION-1. Prepare a Write-up

INSTRUCTION-2. Come up with content on Latest Technology or as advised by the Faculties.

INSTRUCTION-3. Prepare a PPT and a report on Seminar and demonstrate same.

Text/Reference Books:

1. Refer online materials.

Web Technology

OPEN Elective LTP:: 2:0:0	Total Credits:2 Hours: 2 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAOE01 Exam Hours: 2	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- learn web technology concepts

Course Outcome:

- Demonstrate better usage of web tools for research.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 26)

UNIT 1

Internet and the Web, Client-Server computing architecture, Multi-tier architecture, Web documents and browsers, URL-Domain name system, Crawling and information retrieval on the web

UNIT 2

Computer Network: LAN-Topology, IP address (IPv4 and IPv6), wireless network. HTTP Protocols, Status codes, HTML Basic tags- Body, Heading, Anchor, Paragraph, Image, Lists, Tables.

Text/Reference Books:

1. Network Topology: The Physical and Logical Structure of a Network Connection Between Model And Nodes
2. Web Technology: Theory and Practice by M. Srinivasan
3. https://www.rgmcet.edu.in/assets/img/departments/CSE/materials/R15/3-/Web%20Technologies.pdf
4. https://mrcet.com/downloads/digital_notes/IT/(R18A0517)%20Web%20Technologies.pdf
5. https://www.vssut.ac.in/lecture_notes/lecture1428550521.pdf

Basics of Latex

OPEN Elective LTP:: 2:0:0	Total Credits:2 Hours: 2 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAOE02 Exam Hours: 2	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- learn latex documentation

Course Outcome:

- Demonstrate the ability to create research document using latex.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 26)

UNIT 1

Introduction to LaTeX. Various integrated development environment (IDE) for LaTeX. Installation of Tex Studio. Online Overleaf access. Structure of LaTeX document. Defining class of the document through \ document class. Packages and different environments. Writing the first LaTeX content. Creating a Title, chapters and sections and their labeling. Additionally, basics of LaTeX syntax. Page style, fonts, font sizes, font styles.

UNIT 2

Labelling Table of Contents, font Effects, coloured text, boxes, theorems, comments & spacing special characters, line breaking. Columns, multi-columns and minipages. Page numbering, foot notes, headers and footers. Insert mathematic symbole/formula, fractions, superscript, subscript, overline, underline. Inserting pictures and tables. Special environments enumerates, tabular, cases etc. Citation in LaTeX using BibTeX. Bibliography styles.

Text/Reference Books:

1. A Short Introduction to Latex: A Book for Beginners. by Firuza Karmali Aibara
2. LaTeX: A document preparation system, User's guide and reference manual
3. https://www.math.ucdavis.edu/~tracy/courses/math129/Guide_To_LaTeX.pdf

   .https://www.colorado.edu/aps/sites/default/files/attached-files/latex_primer.pdf

Problem Solving Techniques

OPEN Elective LTP:: 2:0:0	Total Credits:2 Hours: 2 hrs./week
Programme: Master of Computer Applications Course Code: :23MCAOE03 Exam Hours: 2	Total Marks: 50 Semester End Exam:40 Continuous Internal Evaluation:10

Course Prerequisite:

- Critical Thinking.

Course Outcome:

- Demonstrate the ability to choose methods appropriate in problem solving.
- Develop advanced critical thinking skills.

Course Content: 13 Hours to Each UNIT (Total Course hrs. 26)

UNIT 1

Introduction: Programs and algorithm, The Role of Algorithms in Computing, Algorithms as a technology, analyzing algorithms, Designing algorithms, Growth of Functions, Asymptotic notation, Standard notations and common functions. Fundamental Algorithms: Exchanging the values of two variables, Summation of a set of numbers, Factorial Computation, Generating of the Fibonacci sequence.

UNIT 2

Flow chart -symbols of flow chart, Types of Flow chart, advantages and disadvantages of flow chart. Use case diagram, State diagram. Write diagram for-sum of numbers, Factorial, Fibonacci.

Text/Reference Books:

1. Flowchart and Algorithm Basics: The Art of Programming
2. The Algorithm Design Manual By Steven S Skiena:
3. https://muzzaffarpur.kvs.ac.in/sites/default/files/kecs104_0.pdf
4. https://python4csip.com/files/download/006%20Problem%20Solving%20&%20Decomposition.pdf
5. https://www.geeksforgeeks.org/use-case-diagram/

Soft Skills (MOOCs / SWAYAM/ NPTEL Courses)/*

EARN 04 CREDITS FROM MOOCS/SWAYAM/NPTEL COURSES

(As per university norms)

*** Students are encouraged to take this Courses during I to IV Semester**	Total Credits:4 Extra Credit earn
Programme: **MOOCs / SWAYAM/ NPTEL Courses**	Semester End Exam: N/A Continuous Internal Evaluation: N/A

Course Prerequisite:

- Online courses and enrollment.

Course Outcome:

- Enroll approved courses (listed by Dept. /University) during 2 years of the course.
- Earn 03 credits upon successful passing exams and producing certificates to Dept.

Guidelines:

1. MHRD has appointed nine National Coordinators viz UGC, NPTEL, CEC, IGNOU, NCERT, NIOS, IIMB, NITTTR and AICTE which have been assigned a specific sector for preparation of online courses for SWAYAM.

2. Learners can choose from hundreds of courses, virtually every course that is taught at the university/college/school level and these shall be offered by best of the teachers in India and elsewhere. More than 1,000 specially chosen teachers and lecturers from across the Country have participated in preparing these courses.

3. The courses delivered through SWAYAM are available free of cost to the learners, however students wanting certifications shall be registered and offered a certificate on successful completion of the course, with a little fee. At the end of each course, there will be an assessment of the student through proctored examination and the marks/grades secured in this exam could be transferred to the academic record of the students. UGC has already issued.

4. The courses delivered through SWAYAM are accessible by any learner free of cost. However, students having registered a course, having submitted the Assignments as per requirements of the course, shall at the end of each course, be assessed through a proctored examination. A student having successfully completed the course shall get a Certificate that shall be issued by Host Institute. The marks/grades secured in this proctored examination could be transferred to the academic record of the students from Host Institute.

5. Refer guidelines at https://www.aicte-india.org/sites/default/files/FAQ SWAYAM.pdf

Text/Reference Books:

1. https://www.aicte-india.org/sites/default/files/FAQ SWAYAM.pdf
2. https://swayam.gov.in/nc details/NPTEL
3. https://onlinecourses.nptel.ac.in/
4. https://www.mooc.org

Note - University/Dept. reserves the right to adapt to new evaluation pattern

Internal Test Question Paper Pattern

First Semester MCA Degree Examinations, MAY -2024

MASTER OF COMPUTER APPLICATIONS

First Test Paper: <Subject>

Time: 1.30 Hours **Max. Marks: 30**

PART-A

Answer **any Two of** the following**:** **(2×5= 10)**

1.

2.

3.

PART-B

Answer **any Two of** the following**:** **(2×10= 20)**

4.

a.

b.

5.

a.

b.

6.

a.

b.

Main Examination Question Paper Pattern

First Semester MCA Degree Examinations, July/Aug-2024

MASTER OF COMPUTER APPLICATIONS

Paper :< Subject>

Time: 3 Hours **Max. Marks: 70**

PART-A

Answer **any Six** of the following**:** **(6×5= 30)**

1.

2.

3.

4.

5.

6.

7.

8.

PART-B

Answer **any Four** of the following***:** **(4×10= 40)**

9.

10.

11.

12.

13.

14.

*PART-B questions can be partitioned into ***A*** and ***B*** sub-questions.

Bridge Course (BC) and Open Elective (OE) Question Paper Pattern

Bridge Course (BC)/Open Elective (OE) MCA Degree Examinations, July/Aug-2024

MASTER OF COMPUTER APPLICATIONS

Paper :< Subject>

Time: 2 Hours **Max. Marks: 40**

PART-A

Answer **any Five** of the following: **(5×2= 10)**

1.

2.

3.

4.

5.

6.

7.

PART-B

Answer **any Two** of the following*: **(2×5= 10)**

9.

10.

11.

PART-C

Answer **any Two** of the following*: **(2×10= 20)**

12.

13.

14.

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