Scheme & Syllabus of
Master of Computer Applications
(MCA)

Batch 2022 onwards

**Department of
Computer Applications**

Shaheed Bhagat Singh
State University

MCA Eligibility

THE GENERAL ELIGIBILITY CRITERIA FOR MCA 2 YEARS (FOUR SEMESTERS):

MCA ELIGIBILITY:

Passed BCA/B.Sc(CS/IT)/B.Voc with Computer as a major subject/Bachelor's Degree in CSE/IT or equivalent degree of minimum three years duration.

Or

Passed B.Sc./ B.Com./ B.A. with Mathematics at l0+2 Level or at Graduation Level (With additional bridge course as per norms of IKG PTU Jalandhar)/ Bridge course will be exempted if the candidate apart from above qualification has passed PGDCA or minimum One Year Diploma in Computer Application/Science/IT or equivalent from any recognized University/Institution.

Note: The candidate must have obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

PROGRAM OUTCOMES (POs)

Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

Problem Analysis: Identify, formulate, research literature, and solve complex computing problem searching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

Design /Development of Solutions: 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.

Conduct investigations of complex Computing problems: User search-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

Project management and finance: 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.

Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complexcomputingactivitiesbybeingabletocomprehendandwriteeffectivereports, design documentation, make effective presentations, and give and understand clear instructions.

Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

Innovation and Entrepreneurship: Identify 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.

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First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
MCCAB1C	Bridge Course*	Computer Programming using C	2	0	0	50	-	50	S/US
MCCAB2C	Bridge Course*	Computer Science Essentials	2	0	0	50	-	50	S/US
MCCA101C	Core Theory	Discrete Structures & Optimization	4	0	0	40	60	100	4
MCCA102C	Core Theory	Programming in Python	4	0	0	40	60	100	4
MCCA103C	Core Theory	Advanced Data Structures	4	0	0	40	60	100	4
MCCA104C	Core Theory	Advanced Database Management System	4	0	0	40	60	100	4
MCCA105C	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	0	0	40	60	100	3
MCCA106C	Core Practical/Laboratory	Data Structures using Python Laboratory	0	0	4	60	40	100	2
MCCA107C	Core Practical/Laboratory	Advanced Database Management System Laboratory	0	0	4	60	40	100	2
MCCA108C	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	0	0	2	30	20	50	1
	TOTAL		19	0	10	350	400	750	24

*Bridge courses are not applicable to all the students, please refer MCA eligibility given above in order to offer bridge courses to students.

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Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
MCCA201C	Core Theory	Web Technologies	4	0	0	40	60	100	4
MCCA202C	Core Theory	Design & Analysis of Algorithms	4	0	0	40	60	100	4
MCCA203C	Core Theory	Advanced Java	4	0	0	40	60	100	4
MCCA204C	Core Theory	Linux Administration	4	0	0	40	60	100	4
MCCA205C	Core Theory	Information Security & Cyber Law	4	0	0	40	60	100	4
MCCA206C	Core Practical/Laboratory	Web Technologies Laboratory	0	0	4	60	40	100	2
MCCA207C	Core Practical/Laboratory	Advanced Java Laboratory	0	0	4	60	40	100	2
MCCA208C	Core Practical/Laboratory	Linux Administration Laboratory	0	0	4	60	40	100	2
HU100C		Introduction to Shaheed Bhagat Singh and his co-patriots	1						S/U
	TOTAL		20	0	12	380	420	800	26
Students will undergo 4 weeks Summer Training after 2nd semester. Examination will be conducted along with 3rd semester practical.									

Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
MCCA301C	Core Theory	Advanced Computer Networking	4	0	0	40	60	100	4
MCCA302C	Core Theory	Artificial Intelligence & Soft Computing	4	0	0	40	60	100	4
MCCA303C	Core Theory	Theory of Computation	4	0	0	40	60	100	4
	Elective – I		4	0	0	40	60	100	4
	Elective – II		4	0	0	40	60	100	4
MCCA304C	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	0	0	4	60	40	100	2
MCCA305C	Core Practical/ Laboratory	Artificial Intelligence & Soft Computing Laboratory	0	0	4	60	40	100	2
	Elective – II Laboratory		0	0	4	60	40	100	2
MCCA306C		**Summer/Institutional Training	0	0	4	60	40	100	2
	TOTAL		**20**	**0**	**16**	**440**	**460**	**900**	**28**

Elective – I	
Course Code	**Course Title**
MCCA311C	Software Project Management
MCCA312C	Data Mining and Business Intelligence
MCCA313C	Enterprise Resource Planning

Elective – II	
Course Code	**Course Title**
MCCA314C	Mobile Applications Development
MCCA315C	e-Commerce and Digital Marketing
MCCA316C	Software Testing & Quality Assurance

Elective – II Laboratory	
Course Code	**Course Title**
MCCA317C	Mobile Applications Development Laboratory
MCCA318C	e-Commerce and Digital Marketing Laboratory
MCCA319C	Software Testing & Quality AssuranceLaboratory

Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
MCCA401C	Core Theory	Machine Learning & Data Analytics using Python	4	0	0	40	60	100	4
MCCA402C	Core Theory	Advanced Web Technologies	4	0	0	40	60	100	4
MCCA403C	Core Practical/ Laboratory	Machine Learning & Data Analytics using Python Laboratory	0	0	4	60	40	100	2
MCCA404C	Core Practical/ Laboratory	Advanced Web Technologies Laboratory	0	0	4	60	40	100	2
	Elective – III		4	0	0	40	60	100	4
	Elective – III Laboratory		0	0	4	60	40	100	2
MCCA405C		Research/Technical Seminar	0	0	2	0	100	100	1
MCCA406C		Project	0	0	8	180	120	300	4
		TOTAL	**12**	**0**	**22**	**480**	**520**	**1000**	**23**

Elective – III	
Course Code	Course Title
MCCA411C	Cloud Computing
MCCA412C	Digital Image Processing
MCCA413C	NLP and Speech Recognition
MCCA414C	IOT &Blockchain Technology

Elective – III Laboratory	
Course Code	Course Title
MCCA415C	Cloud Computing Laboratory
MCCA416C	Digital Image Processing Laboratory
MCCA417C	NLP and Speech Recognition Laboratory
MCCA418C	IOT &Blockchain Technology Laboratory

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Course Code: MCCAB1C
Course Name: Computer Programming using C

Program: MCA (Bridge Course)	**L**: 2 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 22 hours
Internal max. marks: 50	**Theory/Practical:** Theory
External max. marks: -	**Duration of end semester exam (ESE):** -
Total marks: 50	**Elective status:** No

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Express the logical flow used in Programming. Design algorithms for solving various real life problems
CO2	Choose the right data type and statements for programs.
CO3	Implement programs using C .
CO4	Explain various concepts of C programming language.
CO5	Understand the core concepts like arrays, functions etc.

Detailed Contents	Contact hours
Unit-I **Logic Development:** Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants. [CO1] [CO4] **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions. [CO1]	6
Unit-II **Data Input and Output:** formatted & unformatted input output. [CO2] **Control Statements:** While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements. [CO2]	8

Unit-III **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays. [CO3] **Strings**: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables. [CO3] **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. [CO3] **Objects and Classes:** Introduction to Object Oriented Concepts, Features of OOP, Basic of classes and Objects. [CO5]	8

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill.
2. Programming in C, Third Edition, Stephen G Kochan, Pearson.
3. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication.

Reference Books:

1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

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Course Code: MCCAB2C
Course Name: Computer Science Essentials

Program: MCA (Bridge Course)	**L**: 2 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 22 hours
Internal max. marks: 50	**Theory/Practical:** Theory
External max. marks: -	**Duration of end semester exam (ESE):** -
Total marks: 50	**Elective status:** No

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Identify various components of computer system including input and output devices.
CO2	Prepare documents using word processing, Spreadsheet and Presentation tools.
CO3	Outline the key components of Database Management system
CO4	Explain the role of operating system.
CO5	Define various components, modes and topologies of computer networks.

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. [CO1] **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. (Brief introduction of all) [CO1] **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. [CO1] **Data Representation:** Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT. [CO1]	7
Unit-II **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors. [CO2] **Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. [CO2] **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows. [CO2]	**7**

Unit-III **DBMS:** Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. [CO3] **Fundamentals of Operating system:** Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems. [CO4] **Data communications concepts:** Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. [CO5] **Types of Networks:** LAN, MAN, WAN, Topologies. [CO5]	**8**

Text Books:

1. Fundamentals of Computers, V Rajaraman,NAdabala, PHI.
2. Computer Fundamentals and Programming in C, Reema Thareja, Oxford University Press, 2016.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
4. Computer Fundamentals, A. Goel, 2010, Pearson Education.
5. Computer Course Windows 10 with MS Office 2016, Satish Jain (Author), BPB Publications.

Reference Books:

1. "Introduction to Computers", Peter Norton

Course Code: MCCA101C
Course Name: Discrete Structures &Optimization

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: Basic Mathematical Knowledge
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain the use of Venn diagrams to solve applied problems.
CO2	Apply rules of inference.
CO3	Write proofs using symbolic logic and Boolean Algebra
CO4	Applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle.
CO5	Identify the type of graphs.

Detailed contents	Contact hours
Part A **Sets, relations, and functions:** Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations.[CO1] **Rings and Boolean algebra:** Rings, Subrings, Morphism of rings ideals and quotient rings. Euclidean domains, Integral domains and fields, Boolean Algebra, Direct product morphisms, Boolean sub-algebra, Boolean Rings, Application of Boolean algebra (Logic Implications, Logic Gates, Karnaughmap) [CO3] **Combinatorial Mathematics:** Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Application.[CO4]	24 Hours
Part B **Monoids and Groups:** Groups, Semigroups and monoids, Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups. [CO2] **Graph Theory:** Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism. Applications. [CO5]	20 Hours

Text Books:

1. Discrete Mathematics (Schaum series), Lipschutz (McGraw Hill).

2. Applied Discrete Structures for Computer Science, Alan Doerr and Kenneth Levarseur (Creative Commons) 2012.

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Reference Books:

1. Discrete Mathematics and its Applications, Kenneth H Rosen.(McGraw Hill)

2. Discrete Mathematics and Graph Theory, Sartha, (Cengage Learning)

3. Elements of discrete mathematics. C L Liu (McGraw Hill)

Course Code: MCCA102C
Course Name: Programming in Python

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 1st	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: -
Internal max. marks: 40	Duration of end semester exam (ESE):3hrs
External max. marks:60	Elective status: Core
Total marks: 100	

Prerequisite: -NA- Co requisite: -NA-
Additional material required in ESE:-NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Explain environment, data types, operators used in Python.
CO2	Compare Python with other programming languages.
CO3	Outline the use of control structures and numerous native data types with their methods.
CO4	Design user defined functions, modules, files, and packages and exception handling_methods.
CO5	Write solutions for Object Oriented Programming Concepts.

Detailed Contents	Contact hours
Part- A	
Introduction to Python Programming Language: Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.[CO1] [CO2]	22 hours
Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. [CO1]	
Operators and Expressions: Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators. [CO1]	
Control Structures: Decision making statements, Python loops, Python control statements. [CO3]	
Python Native Data Types: Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations). [CO3]	
Part- B	
Python Functions: Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. [CO4]	22 hours
Python Modules: Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages. [CO4]	
Exception Handling: Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. [CO4]	
File Management in Python: Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. [CO4]	
Classes and Objects: The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects. [CO5]	

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: MCCA103C
Course Name: Advanced Data Structures

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits: 4**
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Understanding data structures with their complexity and types of analysis.
CO2	Execute the operations of hashing to retrieve data from data structure.
CO3	Design and analyze programming problems based upon sorting techniques.
CO4	Analysis of various graphical problems.
CO5	Analysis of Algorithms based upon strings.

Detailed contents	Contact hours
Part A Introduction to Data Structures: Data Structures and its Types, Algorithms, Time Complexity, Recurrence, Probabilistic Analysis, Amortized Analysis, Competitive Analysis. [CO1]	22 Hours

Sorting Algorithms: Quick Sort, Heap Sort, Counting Sort, Bucket Sort, Multi-way Merge Sort. [CO1] Hashing Techniques: Direct Address Tables, Hash Tables, Hash Functions, Open Addressing, Perfect Hashing. [CO2] Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Binomial Heaps, Fibonacci heaps, Data Structures for Disjoint Sets. [CO4]	
Part B Graphs & Algorithms: Graphs Representation, Minimum Spanning Tree (MST), Single Source Shortest Paths, All Pairs Shortest Paths, Maximum Flow. [CO3] String Matching: String, String Length, String Concatenation, String Copy, String-Matching, Brute Force algorithm, Rabin Karp algorithm, Knuth-Morris-Pratt (KMP) algorithm, Boyer–Moore algorithm. [CO5]	22 Hours

Text Books:

1. Thomas Coremen, "Introduction to Algorithms", Third edition, Prentice Hall of India, 2009.

Reference Books:

1. Kleinberg J., Tardos E., "Algorithm Design", 1st Edition, Pearson, 2012.
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., "Data Structures and Algorithms", Addison Wesley, 2001.
3. Seymour Lipschutz, "Data structure", Indian Adapted Edition, Tata McGraw Hill, 200

Course Code: MCCA104C
Course Name: Advanced Database Management System

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Express the basic concepts of DBMS and RDBMS.
CO2	Apply normalization theory to the normalization of a database
CO3	Explain Transaction Management & Recovery techniques in RDBMS.
CO4	Outline characteristics of advanced databases prevailing in market.
CO5	Demonstrate No SQL databases (Open Source)

Detailed contents	Contact hours
Part A Need of DBMS over traditional Data storage mechanisms, Basic DBMS terminologies; Architecture of a DBMS: Data Independence, DBMS Component Structure, DBMS USERS, various DBMS Data Models, [CO1] **Conceptual Model**: Entity Relationship Model, Importance of ERD, Symbols (Entity:Types of Entities, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality). [CO1] **Normalization** and its various forms, Functional Dependencies, Multi-valued Dependencies, Join Dependencies Database Integrity: Domain, Entity, Referential Integrity Constraints.[CO2] **Relational Languages**: Relational Algebra, Relational Calculus, Query Execution, optimization and evaluation Plans. [CO1] **Transaction Management and Concurrency Control** techniques, Database Recovery Management Concepts and methods. [CO3] Introduction and Need of **Database Administration** and activities of Database administration. [CO4]	22 Hours
Part B **Parallel Databases :** Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems-Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism. [CO4] **Distributed Database Concepts** : Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing. [CO4] **Multidimensional Databases** and their uses in data analytics.	22 Hours

Temporal Databases : Introduction to Temporality, Temporal relationships, temporal hierarchies. [CO4] **Spatial Databases:** Spatial data types, spatial relationships, Topological Relationships, Spatial Data Structures and methods of storage. [CO4] **Big Data :** introduction: introduction to **NOSQL Databases** (Open Source only). [CO5] Need and usage of **XML Databases:** XML Data Model – DTD – XML Schema. [CO5]

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concept", Sixth Edition, 2013, McGraw-Hill
2. Bipin C. Desai, "An Introduction to Database System" , Revised Edition, 2012, Galgotia Publications Pvt Ltd-New Delhi

Reference Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition,2009, BPB Publications
2. Peter Rob Carlos Coronel, "Database Systems", Cengage Learning, 8th ed.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, 2006, Pearson Education.

Course Code: MCCA105C
Course Name: Technical Communication

Program: MCA	**L:**3 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 3
Semester: 1st	**Contact hours:** 33 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:**Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

CO#	Course Outcomes:
CO1	Outline the benefits of effective communication
CO2	Accomplish proficiency in reading & listening, comprehension, speaking skills.
CO3	Apply spoken and written English language in their chosen technical field.
CO4	Demonstrate fluency in conversation.
CO5	Write their own clear and coherent texts.

Detailed contents	Contact hours
Part A **Basics of Technical Communication:** Functions of Communication-Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7C's and other principles), Non-verbal Communication. [CO1] **Basic Technical Writing:** Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters– Format &various types. [CO2]	16 Hours
Part B **Advanced Technical Writing:** Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, Notices. Resume Writing, Technical Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography. [CO2] [CO3] **Verbal Communication:** Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences. [CO4] **Technical Communication:** MS-Word, Adobe Frame maker and ROBO Help [CO5] * Lab Exercises based on Listening and Speaking skills	17 Hours

Text Books:

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi.

2. K KRamchandran, et al Business Communication, Macmillan, New Delhi.

3. Swati Samantaray, Business Commnication and Commnicative English, Sultan Chand, New Delhi.

4. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD).

Course Code: MCCA106C

Course Name: Data Structures using Python Laboratory

Program: MCA	**L**: 0**T**:0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE): -**
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of concepts of Data Structures

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

	Course outcomes
CO1	Analyze various algorithms based on their time and space complexity.
CO2	Create different data structures in C/ C++
CO3	Implement various operations of all data structures
CO4	Illustrate the outcome of various operations with the help of examples.
CO5	Write programs to implement various types of searching and sorting algorithms

LIST OF EXPERIMENTS	
1	Write a Python program to create an array of 5 elements and display the array items. Access each individual element through indexes.
2	Write a Python program to reverse the order of the items in the array.
3	Write a Python program to append a new item to the end of the array.
4	Write a Python program to remove a specified item using the index from an array.
5	Write a Python program to get the length of an array.
6	Write a Python program for binary search.
7	Write a Python program for sequential or linear search.
8	Write a Python program to sort a list of elements using the bubble sort algorithm.
9	Write a Python program to sort a list of elements using the selection sort algorithm.
10	Write a Python program to sort a list of elements using the insertion sort algorithm.
11	Write a Python program to sort a list of elements using the quick sort algorithm.
12	Write a Python program to create a singly linked list, append some items and iterate
13	Write a Python program to find the size of a singly linked list.

14	Write a Python program to search a specific item in a singly linked list and return true if the item is found otherwise return false.
15	Write a Python program to delete the first item from a singly linked list.
16	Write a Python program to create circular single linked lists.
17	Write Python programs to implement stack and its operations using list.
18	Write Python programs to implement queue and its operations using list.
19	Write a Python program to create a Balanced Binary Search Tree (BST) using an array (given) elements where array elements are sorted in ascending order.
20	Write a Python program to find the kth smallest element in a given a binary search tree.
21	Write a Python program to traverse the binary tree using pre-order, post-order and in-order traversals.
22	Write a Python program to count the number of nodes in binary search tree.
23	Write a Python program to traverse the graph using Depth First Search and Breadth First Search
24	Write a Python program to create Red Black Tree and perform operations of Insertion and Deletion in it.
25	Write a Python program to implement AVL Trees as well as various operations of searching, insertion and deletion on AVL Trees.

Text Books:

1. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.

2. Y Daniel Liang, "Introduction to Programming using Python", Pearson.

3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.

Reference Books:

1. Hemant Jain, "Problem Solving in Data Structures and Algorithms using Python: programming interview guide", 2016.
2. Zed A. Shaw, "Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code", 3e, Addison-Wesley, 2014.

Course Code: MCCA107C

Course Name: Advanced Database Management System Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 1st	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** -
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Apply all possible integrity constraints into the database to maintain the integrity and consistency of data.
CO2	Perform various types of SQL queries to retrieve data from multiple tables (Two or Three)
CO3	Suggest and create some suitable views based on the database from one or more Tables.
CO4	Use various oracle function including group functions through multiple table.
CO5	Perform some select command on view created from one or more Tables.

S.No.	Practical Assignments
1.	Database design using E-R model and Normalization (Any 3 systems).
2.	Implementation of DDL Commands to perform creation of table, alter, modify and drop column operations.
3.	Implementation of Constraint ▪ Check Constraint ▪ Entity Integrity Constraint ▪ Referential Integrity Constraint ▪ Unique Constraint ▪ Null Value Constraint
4.	Implementation of DML and DCL Commands.
5.	Implementation of Data and Built in Functions in SQL.
6.	Implementation of Nested Queries and Join Queries.
7.	Implementation of Cursors.
8.	Implementation of Procedures and Functions.
9.	Implementation of Triggers.
10.	Implementation of Embedded SQL.
11.	Consider a Database applications, Design and Develop Conceptual Data Model (E-R Diagram) with all the necessary entities, attributes, constraints and relationships. Design and build Relational Data Model for application specifying all possible constraints.
12.	Implementation of various DBA roles/techniques ▪ Creation of user ▪ Granting of privileges to the users ▪ Creation of roles ▪ Loading of privileges into user defined roles. ▪ Import/Export data between various databases and flat files

Text Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition,2009, BPB Publications.

2. Steven Feuerstein and Bill Pribyl, "Oracle PL/SQL Programming", 5th Edition, 2009, O'Reilly Media.

Course Code: MCCA108C
Course Name: Technical Communication Laboratory

Program: MCA	**L**:0 **T**:0 **P**:2
Branch: Computer Applications	**Credits:** 1
Semester: 1st	**Contact hours:** 2 hours per week
Internal max. marks: 30	**Theory/Practical:**Practical
External max. marks: 20	**Duration of end semester exam (ESE):** -
Total marks: 50	**Elective status:**Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Students will be able to use language accurately, fluently and appropriately
CO2	To show their skills of listening, understanding and interpreting.
CO3	To write project reports, reviews and resumes
CO4	To express their ideas relevant to given topics
CO5	Students will also exhibit advanced skills of interview, debating and discussion.

Assignments:

Interactive practice sessions in Language Lab on Oral Communication	
1.	Listening Comprehension
2.	Self-Introduction, Group Discussion and Role Play
3.	Common Everyday Situations: Conversations and Dialogues
4.	Communication at Workplace
5.	Interviews
6.	Formal Presentations

Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.

2. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Code: MCCA201C
Course Name: Web Technologies

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks:100	

Prerequisite: Student must have the basic knowledge of any text editor like Notepad, Notepad++ and Edit plus etc.

Co requisite: Student must know the background of Markup Language.

Additional material required in ESE:

➢ Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
➢ Developed Website/s must be made online by the student/s.
➢ Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Create pages with simple tags in HTML
CO2	Design webpages with multiple sections or frames
CO3	Explain how to link webpages through hypertext or images a links
CO4	Outline the key web designing concepts using java script
CO5	Design forms with special controls using HTML

Detailed Contents	Contact hours
Part-A **Internet Basics:** Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, How IP addressing came into existence? A brief overview TCP/IP and its services, transmission control protocol. **Introduction To HTML:** Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags,	24 hours

Singular Tags), Commonly Used HTML Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines). [CO1] **Basic Formatting Tags**: HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. [CO1] **Type of Lists** (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. [CO1] **Adding Graphics To HTML Documents:** Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute. [CO1] **Tables:** Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell padding Attribute, Using the Cell spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes Tag. [CO1]	
Part-B **Linking Documents:** Links (External Document References, Internal Document References), Image As Hyperlinks. [CO3] **Frames:** Introduction to Frames: The<FRAMESET> tag, The <FRAME> tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style. [CO2] **Introduction to JavaScript:** Introduction to JavaScript: JavaScript in Web Pages (Netscape and JavaScript, Database Connectivity, Client side JavaScript, Capturing User Input); The Advantages of JavaScript (an Interpreted Language, Embedded within HTML, Minimal Syntax -Easy to Learn, Quick Development, Designed for Simple, Small Programs, Performance, Procedural Capabilities, Designed for Programming User Events, Easy Debugging and Testing, Platform Independence/Architecture Neutral); Writing JavaScript into HTML. [CO4] **Forms Used by a Web Site:** The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element) Other Built-In Objects in JavaScript (The String Object, The Math Object, The Date Object), User Defined Objects (Creating a User Defined Object, Instances, Objects within Objects). [CO5]	20 hours

Text Books:

1. Internet for EveryOne: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.

2. Greenlaw R; Heppe, "Fundamentals of Internet and WWW", 2nd Edition, Tata McGraw-Hill, 2007.

3. RajKamal, "Internet& Web Technologies",edition Tata McGraw-Hill Education.2009.

4. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.

5. A Beginner's Guide to Html Http://www.Ncsa.Nine.Edit/General/Internet/Www/Html.Prmter

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/html/html_tutorial.pdf

2. https://www.w3schools.com/js/

3. https://www.w3schools.com/html/

4. https://www.cs.uct.ac.za/mit_notes/web_programming.html

5. http://www.pagetutor.com/table_tutor/index.html

Course Code: MCCA202C
Course Name: Design & Analysis of Algorithms

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks:40	**Duration of end semester exam (ESE):** 3hrs
External max. marks:60	**Elective status:** Core
Total marks: 100	

Prerequisite: -Student must have knowledge about Data Structures**.**
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understanding the concepts of asymptotic notations, divide and conquer and backtracking
CO2	Understanding Algorithms based upon sorting techniques.
CO3	Understanding algorithm for graph traversals.
CO4	Classify problems as P, NP or NP Complete

Detailed contents	Contact hours
Part A **Algorithms:**Analyzing algorithms, order arithmetic, Time and space complexity of an algorithm, comparing the performance of different algorithms for the same problem. Different orders of growth. Asymptotic notation. Polynomial vs. Exponential running time. Principles of Algorithm Design. Mathematical analysis of Recursive and Non-recursive algorithms. [CO1] **Basic Algorithm Design Techniques:** Divide-and-conquer, Greedy approach, Randomizationand dynamic programming. [CO2] [CO4] **Example problems on Backtracking:** n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and- Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem. [CO2] [CO4]	24 Hours
Part B **Sorting and searching:** Insertion and selection sort, Binary search in an ordered array. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, and Bubble sort with analysis of their running times. Lower bound on sorting. Exhaustive search and String Matching. [CO3] [CO4] **Graphs and NP-completeness:** Graph traversal: Breadth-First Search(BFS) and Depth-First Search (DFS). Applications of BFS and DFS. Shortest paths in graphs: Dijkstra algorithm. Definition of class NP, P, NP-hard and NP-complete problems. [CO5]	20 Hours

Text Books:
1. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publication
2. A.V.Aho, J.E.Hopcroft, and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education India
3. J.Kleinberg and E.Tardos, Algorithm Design by, Pearson Education India
4. Coremen T.H., Leiserson C.E., and Rivest R.L.: Introduction to Algorithms, PHI

Reference Books:
1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson Education, 2nd Edition.
2. Michael T Goodrich and Roberto Tamassia : Algorithm Design, Wiley India
3. R C T Lee, S S Tseng, R C Chang, Y T Tsai : Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill

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Course Code: MCCA203C
Course Name: Advanced Java

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the concept of advanced features in Java
CO2	Understand the concept of Java servelts and JSP
CO3	Learn the basic structure of advanced java program
CO4	Understand the struts framework in J2EE applications
CO5	Understand the concept of Java Beans and Learn to develop remote java applications

Detailed contents	Contact hours
Part A **Servlets:** The life cycle of Servlet, Java Servlet Development kit, Servlet API, Reading the servletparameters, Reading initialization parameters, Handling HTTP requests and responses, Using cookies, Session tracking and security issues.[CO1] **Java Server Pages (JSP):** JSP Architecture, Life cycle of JSP, JSP syntax basics–Directives, Declarations, Scripting, Standard actions, Custom tag libraries, Implicit objects, Object scope. Synchronization issues, Session management. [CO3] **Struts :** Introduction to struts framework, understanding basic architecture of Model, view, controller. Deploying the application in struts with database connectivity.	22 Hours
Part B **Hibernate :** Introduction to hibernate framework, understanding basic architecture of Model, view, controller. Basic concepts of creating pojo files, reverse mapping, object creation in hibernate, database connectivity. [CO4] **Enterprise Java Bean:** The bean developer kit (BDK), Use of JAR files, The java beans API, Creating a JavaBean, Types of beans, Stateful session bean, Stateless session bean, Entity bean. [CO4]	22 Hours

Remote Method Invocation: Defining the remote interface, Implementing the remote interface, Compiling and executing the server and the client. [CO5] **Common Object Request Broker Architecture (CORBA):** Overview of technical architecture, CORBA basics, CORBA services. [CO5]	

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw -Hill.

2. H.M. Deital, P.J. Dietal and S.E. Santry, "Advanced Java 2 Platform HOW TO PROGRAM", Prentice Hall.

Reference Books:

1. Grey Cornell and Hortsmann Cay S., "Core Java", Sun Microsystems Press.

2. Philip Hanna, "JSP: The Complete Reference", Tata McGraw –Hill.

Course Code: MCCA204C
Course Name: Linux Administration

Program: MCA	**L**:4 **T**:0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite:
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Explain the fundamentals concept of open source operating system.
CO2	Understanding the basic set of commands and editors in Linux operating system.
CO3	Discuss shell programming in Linux operating system.
CO4	Demonstrate the role and responsibilities of a Linux system administrator.
CO5	Distinguish various filters and server commands.

Detailed contents	Contact hours
Part A **Introduction:** Linux: The Operating System: Linux Distributions, Difference Between Linux and Windows, Separation of the GUI and the Kernel, Understanding Linux Kernel, Installing Linux in a Server Configuration, Booting and Shutting Down Process, Concept of Root, Basic commands, working with vi Editor. [CO1] **Understanding files and File System:** Understanding Files and Directories in Linux, File Structure and hierarchy, File Permissions, File Management and Manipulation, Managing File System. [CO3] **Managing Packages & Users:** Installing and removing Software in Linux, Getting and Unpacking the Package, Configuring the Package, Compiling the Package, Installing the Package, Managing Users and Groups. [CO4]	22 Hours
Part B **DNS:** Installing a DNS Server, Configuring a DNS Server, DNS Records Types, Setting Up BIND Database Files, The DNS Toolbox, Configuring DNS Clients. **Web Server:** Understanding the HTTP Protocol, Installing the Apache HTTP Server, Starting Up and Shutting Down Apache, Configuring Apache. **E-Mail Server:** Understanding SMTP, Installing the Postfix Server, Configuring the Postfix Server, Running the Server, POP and IMAP Basics, Installing the UW-IMAP and POP3 Server **Samba Server:** The Mechanics of SMB, Samba Administration, Using SWAT, Creating a Share, Mounting Remote Samba Shares, Creating Samba Users, Using Samba to Authenticate Against a Windows Server. [CO5]	22 Hours

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India

Shaheed Bhagat Singh State University
Master of Computer Applications (MCA)

Course Code: MCCA205C
Course Name: Information Security and Cyber Law

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2ⁿᵈ	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Identify issues involved in the field of information security.
CO2	Explain the key security requirements of Confidentiality, Integrity &Availability.
CO3	Demonstrate the concept of Intrusion Detection & Intrusion Prevention.
CO4	Apply Symmetric Encryption techniques.
CO5	Describe the concept of Security policies and Cyber Laws.

Detailed contents	Contact hours
Part A	22 Hours
Introduction to Information System, classification and components of information system, Computer Security Concepts, CIA (Confidentiality, integrity and availability),Security Functional Requirements.[CO1] [CO2]	
User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. [CO2]	
Access Control: Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, File Access Control, Role-Based Access Control.	
Database Security: The Need for Database Security, Database Access Control, Database Encryption.	
Malicious Software: Types of Malicious Software (Malware)-Viruses, Worms,SPAM E-mail, Trojans, Zombie, Bots, Keyloggers, Phishing,	

Spyware, Backdoors, Rootkits, Preventive Measures.Denial-of-Service Attacks: Types of DoS attacks, Defenses Against Denial-of-Service Attacks.	
Part B **Intrusion Detection:** Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots. [CO3] **Firewalls & Intrusion Prevention Systems:** The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems. **Cryptographic Algorithms:** Symmetric Encryption Principles, Data Encryption Standards (DES) [CO4] **Introduction to Internet Security Protocols & Standards:** SSL, TLS, HTTPS, IPv4 and IPv6 Security protocols. **Security Policies and Cyber Laws:** Concept of Information Security Policy, ISO Standards, various Indian Cyber Laws, Information Technology Act 2000, Electronic Record and E-Governance, Classification and Provisions of Cyber Crimes, Regulation of Certifying Authorities, Patent, Copyright, Digital signature, Introduction to Cyberspace. [CO5]	22 Hours

Text Books:

1. William Stallings, Lawrie Brown, "Computer Security: Principles & Practice", 3rd Edition, Pearson, 2015.

2. Surya Prakash Tripathi, RitendraGoel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", Wiley India,2014.

Reference Books:

1. Christof Paar , Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", 1st Edition, Springer, 2010

2. William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Prentice Hall, 2006.

3. Darren Death, "Information Security Handbook", Packt Publishing, 2017

Course Code: MCCA206C
Course Name: Web Technology Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:**4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of End Semester Exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.

Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.

Additional material required in ESE:
➤ Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
➤ Developed Website/s must be made online by the student/s.
➤ Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Design pages with simple tags in HTML
CO2	Create web pages with Audio and Video content in it.
CO3	Illustrate the movement from one web page to another
CO4	Implement advanced web designing concepts using java script
CO5	Execute a small web passed project for the benefit of society

Instructions: Instructor can increase/decrease the experiments as per the requirement.

1.	Design index page of a book Titled Web Designing.
2.	Create a simple HTML page to demonstrate the use of different tags.
3.	Display Letter Head of your college on a web page & it must be scrolling Right to Left.
4.	Create a link to move within a single page rather than to load another page.
5.	Display "Name of University" using different Text formatting Tags.
6.	Design Time Table of your department and highlight most important periods.
7.	Use Tables to provide layout to your web page.
8.	Embed Audio and Video into your web page.
9.	Divide a web page vertically and display logo of your college in left pane and logo of university in right pane.
10.	Create Bio- Data of an employee.
11.	Design front page of a hospital with different styles.

12.	Design a web page and display horizontally two different web pages at a time.
13.	Write a program to create a login form. On clicking the submit button, the user should get navigated to a profile page.
14.	Write a HTML code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials.
15.	Write a HTML code to create website in your college or department and create link for Tutorial of specific subject.
16.	Write a program to perform following operations on two numbers input by the user: Addition 2) Subtraction 3) Multiplication 4) Division.
17.	Design a program to solve quadratic equations.
18.	Write a program to determine greatest number of three numbers.
19.	Write a script to compute, the Average and Grade of students marks.
20.	Design a calculator and make event for each button using scripting language.
21.	Write a script to check whether a number is even or odd?
22.	Write a program to show whether a number is prime or not?
23.	Write a program to show multiplication table of any number.
24.	Write a program to find the factorial of any number.
25.	Write a program to show Fibonacci Series between 0 to 74.

Reference Books:

1. Greenlaw R; Hepp E, "Fundamentals of Internet and www", 2nd Edition, Tata. McGraw-Hill, 2007.

2. A Beginner's Guide to HTML Http://www.Ncsa.Nine.Edit/General/Internet/www/ html.prmter.

Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

Course Code: MCCA207C
Course Name: Advanced Java Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 2nd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** -
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-
Course Outcomes: Students will be able to:

	Course Outcomes
CO1	Implement servlets to handle HTTP requests
CO2	Demonstrate session and cookies management
CO3	Implement the concept of database management.
CO4	Outline the concept of SEO.
CO5	Create applications using advanced concepts like JavaBean, Struts, Hibernate, etc.

S.No.	Practical Assignments (Java)
1.	Create a Servlet to handle HTTP Requests and Responses.
2.	Implementation of the concept of Cookies and Session Tracking.
3.	Illustrate the concept of JavaServer Pages (JSP).
4.	Create a JavaBean by using Bean Developer Kit (BDK).
5.	Implementation of various types of beans like Session Bean and Entity Bean.
6.	Introduction to Struts platform with basic connectivity.
7.	Deploying first sample program using MVC architecture in struts.
8.	Implementing database connectivity in struts.
9.	Creating one sample application in struts.
10.	Introduction to Hibernate framework.
11.	Creating simple Hibernate application.
	Practical Assignments (SEO)
12.	Take a web site and prepare the SEO report of the website including status of following factors: Title tag, meta-description tag, header tags, keyword consistency, number of back links, robots.txt and xml sitemaps then after going through the steps of SEO prepare the report.
13.	Discuss any five tools to prepare the list of ten organic key words for SEO purpose.
14.	Optimize the images in the website using suitable methods and compare the reports before and after the SEO steps.
15.	Write the robot and sitemap file of a website under consideration.

Text Books:
1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, "Advanced Java 2 Platform How To Program", Prentice Hall.
3. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education

4. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:
1. Grey Cornell and Hortsmann Cay S., "Core Java", Sun Microsystems Press.
2. Philip Hanna, "JSP: The Complete Reference", Tata McGraw –Hill..

--------- **Course Code: MCCA208C**
Course Name: Linux System Administration Laboratory

Program: MCA	**L**: 0 **T**:0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 2nd	**Contact hours:** 4 hours per week
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:60	**Duration of end semester exam (ESE): -**
External max. marks:40	**Elective status:** Core
Total marks: 100	

Prerequisite:
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	To Install Ubuntu Linux and LINUX Commands.
CO2	Write a Shell Script that accepts a file name, starting and ending line numbers as arguments and displays all lines between the given line numbers.
CO3	Write a shell script that deletes all lines containing the specified word in one or more files supplied as arguments to it.
CO4	Write a shell script that displays a list of all files in the current directory to which the user has read, write and execute permissions.
CO5	Write a shell script to list all of the directory files in a directory.

Lab Practicals

S.No	Practical Assignments
1	Installation of Linux operating system. a. Partitioning drives b. Configuring boot loader (GRUB/LILO) c. Network configuration d. Setting time zones e. Creating password and user accounts f. Installing and removing packages g. Shutting down
2.	Working with basic commands

3.	Linux system administration a. Becoming super user b. Temporarily changing user identity with su command c. Using graphical administrative tools d. Administrative commands e. Administrative configuration files
4.	Configuring NICs with Network Device Configuration Utilities (ip and ifconfig)
5.	Install and configuring a DNS Server with a domain name of your choice.
6.	Install and configuring DHCP server and client
7.	Install and configuring Mail Server
8.	Install and configuring Apache Web Server for hosting websites
9.	Securing a simple network with Linux firewall (Netfilter/iptables)
10.	Setting up Samba Server to share files and printers with Windows-based and other operating systems

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education
3. Linux Command Line and Shell Scripting Bible, 3rd Edition Richard Blum, Christine Bresnahan, Wiley

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India.

Course Code: HU100C

Course Name: Introduction to Shaheed Bhagat Singh and his co-patriots

1. Introduction to Shaheed bhagat Singh as a person through the eyes of his collogues.

Family background and childhood, Education and participation in National Freedom Movement, his visits to Jallianwala Bag and Nankana Sahib.

2.His contribution to National Freedom Moment.

Building of Youth Movement, His contribution through his writing, National college Movement and his comrads, Dwarka Das Library and Lahore Science movement, List of books Shaheed Bhagat Singh.

3.**Shaheed Bhagat Singh's experiences at Kanpur**

As journalist and joining Hindustan Republican Association.

4. His return to Punjab

Jaito Morcha, His first experience of underground life, Shaheed Bhagat Singh at Kiriti Magazine, Establishment Hindustan Socialist Republican Association

5.Overall contributions and his vision of free India.

Reference Books:

1. Sardar Bhagat Singh by Jatinder Nath Sanyal, National Book Trust, New Delhi
2. Bhagat Singh Enduring Legacy for Justice, Libert and Equality, Published by Social Change Papers New Delhi
3. Shaheed Bhagat Singh and his comrades by Prof Jagmohan Singh Chetna Parkashan, Punjabi Bhawan Ludhiana.
4. Yash ki Dhrohar Edited by Banarsi Das Chaturvedi Published by Atama Ram and Sons, Delhi
5. Samaritian By Shiv Verma Published by Lok Parkashan Greh, Delhi
6. Amar Shaheedon ke Sansmarn by Raja Ram Shashtri Published by Sadhana Sahitya Mander Parkashan Kanpur
7. Bhagat Singh The Eternal Rebal by Malwinder jit Singh Waraich, Published by Unistar Book Pvt. Ltd.
8. www.shaheed bhagatsingh.org

Course Code: MCCA301C
Course Name: Advanced Computer Networking

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

COs	Course outcomes
CO1	Learn about Computer Network Structure and Architecture
CO2	Identify the role played by different layers of network model
CO3	Outline the concept of Internet protocols and network security.
CO4	Highlight the benefits of Adhoc networks
CO5	Explain the protocols used in wireless communication systems.

Detailed contents	Contact hours
Part A **Computer Networks**: Uses of computer Networks, Goals and applications of networks, Computer Network Structure and Architecture, Reference models: OSI model.[CO1] **Physical Layer:** Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared) [CO2] **Data Link Layer**: Design issues, Framing, Error detection and correction codes: parity, checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP. [CO2] **Network Layer:** Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms. [CO2] [CO3] **Medium Access Sub-Layer**: Static and dynamic channel allocation, Random Access: ALOHA, CSMA-CA/CD protocols, Controlled Access: Polling, Token Passing. [CO2] **Transport Layer**: Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison. [CO2] **Application Layer:** World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP) TCP/IP model, Comparison of TCP/IP and OSI models. [CO2]	22 Hours
Part B	22 Hours

An Overview of Select Wireless and Mobile Networking Technologies: Principles, WLANs: IEEE 802.11,Cellular Networks, Issues in Seamless Mobility **Adhoc networks:** Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. [CO4] **Wireless Communication Systems**: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. [CO5] **Wireless System Design:** Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems. [CO5]	

Text Books:

1. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall, 1999.

2. Data Communications & Networking by Forouzan, Tata McGraw Hills.

3. Larry L. Peterson & Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann / Elsevier, New Delhi, 2012, reprint 2016.

4. James F. Kurose & Keith W. Ross: Computer Networking: A Top-Down Approach, 7 th Edition, Pearson Education Inc. Boston, 2016.

Reference Books:

1. D.E. Cormer," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.

2. D. Bertsekas and R.Gallagar, "Data Networks", 2nd Edition, Prentice-Hall, 1992.

3. Stevens W.R.," UNIX Network Programming," Prentice Hall, 1990.

Course Code: MCCA302C
Course Name: Artificial Intelligence & Soft Computing

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand Artificial Intelligence concepts and its significance in knowledge representation.
CO2	Explore search techniques, their advantages, disadvantages and comparative analysis
CO3	Understand neural networks and fuzzy logic concepts
CO4	Application of neural networks and fuzzy logic theory for real-world problems.
CO5	Understand Genetic algorithms and their applications in optimized solutions to real-world problems.

Detailed contents	Contact hours
Part A **Introduction**-What is intelligence? Foundations of artificial intelligence (AI).History of AI. AI problems: Toy Problems, Real World problems- Tic-Tac-Toe, Water Jug, Question-Answering, 8-puzzle, 8-Queens problem. Formulating problems, Searching for Solutions. [CO1] **Knowledge Representation:** Propositional Logic, Propositional Theorem proving-Inference and Proofs, Proof by Resolution, Horn Clauses and definite Clauses, Forward and Backward chaining; First order Logic, Inference in First order Logic. [CO1] **Informed (Heuristic) Search Strategies-**Hill Climbing, Simulated Annealing, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search. [CO2] **Natural language processing:** Grammars, Parsing, Semantic Analysis and Pragmatics.	22 Hours
Part B **Introduction:** What is Soft Computing? Difference between Hard and Soft Computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing. **Neural Networks:** Introduction, What is Neural Network, Learning rules and various activation functions, Supervised Learning Networks, Single layer Perceptrons, Back Propagation networks, Architecture of Back propagation(BP)Networks, Back propagation Learning, Variation of Standard Back propagation Neural Network, Introduction	22 Hours

Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications. Unsupervised Learning Networks. [CO3] [CO4]	
Fuzzy Systems: Fuzzy Set theory, Fuzzy vs. Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method,Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, FuzzyDecision Making, Fuzzy Control Systems, FuzzyClassification. [CO3] [CO4]	
Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GAOperators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization. Introduction to Hybrid Systems. [CO5]	

Text Books:

1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed.,Tata McGraw-Hill.
3. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications,S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Artificial Intelligence-A new Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.
2. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
3. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

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Course Code: MCCA303C
Course Name: Theory of Computation

Program: MCA	**L:**4 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:**
Internal max. marks: 40	**Duration of end semester exam (ESE):**
External max. marks:60	**Elective status: core/elective** Core
Total marks:100	

Prerequisite:NA
Co requisite:NA
Additional material required in ESE:NA
Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Understand the basic concepts of formal languages, automata and grammar types, as well as the use of formal languages and reduction in normal forms
CO2	Design Finite Automata's for different Regular Expressions and Languages.
CO3	Prepare context free grammar for various languages.
CO4	Illustrate how push down automata and Turing Machine can be used to solve computational problems.
CO5	Understand recursive and recursively enumerable language and computational complexity.

Detailed contents	Contact hours
Part A Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox. **Theory of Automata:** Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata. [CO1] **Regular Sets and Regular Grammars:** Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis. [CO2] **Context Free Language:** Properties of Context Free Language, Chomsky Classification of Languages, Context Free Grammar, Simplification of Context Free Grammar, Chomsky Normal Form, Greibach Normal Form. [CO3]	22 hours
Part B **Push Down Automata:** Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA). [CO4] **Turing Machines (TM):** Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis. [CO4] **Recursive and Recursively-Enumerable Languages;** Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems. **Unsolvable Problems and Computational Complexity:** Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems. [CO5]	22 hours

Text Books:

1. Jeffrey Ullman and John Hopcroft, Introduction to Automata Theory, Languages, and Computation, 3e, Pearson Education India (2008).
2. K.L.P. Mishra, Theory of Computer Science: Automata, Languages and Computation, Prentice Hall India Learning Private Limited (2006).
3. John Martin, Introduction to Languages and the Theory of Computation, McGraw-Hill Higher Education (2007).

Reference Books:

1. Introduction to Computer Theory, Daniel. I.A. Cohen , John Wiley & Sons.

Course Code: MCCA304C
Course Name: Advanced Computer Networking Laboratory

Program: MCA	**L**:0**T**:0 **P**:4
Branch: Computer Applications	**Credits:** 2
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):**
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: Computer Networks
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Demonstrate sharing of resources of network.
CO2	Prepare different types of network cables.
CO3	Write programs for simulating routing algorithms
CO4	Implement the configuration of Adhoc networks
CO5	Execute configuration of wireless access points

S.No.	Name of Experiment
1.	Familiarization with Networking Components and devices: LAN Adapters, Switches, Routers etc.
2.	Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
3.	Preparing Straight and Cross Cables.

4.	Study of various LAN Topologies and their creation using Network devices, Cables and Computers.
5.	Configuration of TCP/IP Protocols in Windows and Linux.
6.	Implementation of File and Printer sharing.
7.	Designing and Implementing Class A, B, C Network.
8.	Subnet Planning and its Implementation.
9.	Installation of ftp server and client.
10.	To develop programs for simulating routing algorithms for Adhoc networks.
11.	To install any one open source packet capture software like packet tracer etc.
12.	To configure Wireless Local Loop.
13.	To configure WLAN.
14.	To configure Adhoc Networks.
15.	To install and configure wireless access points.

Text Books:

1. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall, 1999.

2. "Data Communications & Networking", Behrouz A. Forouzan, Fifth Edition,Tata McGraw Hill.

Reference Books:

1. D.E. Cormer," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.

2. D. Bertsekas and R.Gallagar, "Data Networks", 2nd Edition, Prentice-Hall, 1992.

3. Stevens W.R.," UNIX Network Programming," Prentice Hall, 1990

Course Code: MCCA305C
Course Name: Artificial Intelligence & Soft Computing Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks:60	**Duration of end semester exam (ESE):** 3hrs
External max. marks:40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Implement basic AI programs.
CO2	Implement artificial neural networks and fuzzy logic theory for real-world problems.
CO3	Understand and prepare training data, validation data and test data.
CO4	Implement neural network using back propagation method
CO5	Implement different operations on fuzzy sets

Instructions: Develop the assignments in MATLAB/Python.

1	Use logic programming in Python to check for prime numbers.
2	Use logic programming in Python parse a family tree and infer the relationships between the family members.
3	Python script for building a puzzle solver.
4	Implementation of uninformed search techniques in Python.
5	Implementation of heuristic search techniques in Python.
6	Python script for tokenizing text data.
7	Extracting the frequency of terms using a Bag of Words model.
8	Predict the category to which a given piece of text belongs.
9	Python code for visualizing audio speech signal
10.	Python code for Generating audio signals
11.	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
12.	Implement AND function using ADALINE with bipolar inputs and outputs.
13.	Implement AND function using MADALINE with bipolar inputs and outputs.
14.	Construct and test auto associative network for input vector using HEBB rule.
15.	Construct and test auto associative network for input vector using outer product rule.
16.	Construct and test heteroassociative network for binary inputs and targets.
17.	Create a back propagation network for a given input pattern. Perform 3 epochs of operation.
18.	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
19.	Maximize the function $f(x)=x^2$ using GA, where x ranges form $0-25$. Perform 6 iterations.

Text Books:
1. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
2. Artificial Intelligence with Python, Prateek Joshi, Packt Publishing.
3. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis &Applications,S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:
1. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
2. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

Course Code: MCCA311C
Course Name: Software Project Management

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 60	**Elective status:** Elective-I
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Describe the principal tasks of software project management
CO2	Outline the basic concepts of Software projects.
CO3	Describe the fundamentals of Process Planning, effort estimation and quality planning.
CO4	Learn risk and quality management.
CO5	Apply management and development practices to develop software.

Detailed contents	Contact hours
Part A **Project Management Fundamentals**- Basic Definitions, Project Stakeholders and Organizational, Influences on Project Management, Project Management Processes, Project Initiating Processes. [CO1] [CO2] **Planning and Resourcing a Project** - Identifying Requirements, Creating the Work Breakdown structure, Developing the Project Schedule, Developing a Project Cost Estimate, Planning Quality, Organizing the Project Team, Planning for Potential Risks.[CO3] **Project Evaluation and Planning** - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit	22 Hours

Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques. [CO3] [CO4]	
Part B **Executing and Managing a Project** -Project Executing Processes-Acquiring and Developing the Project Team, Managing the Project Team, Managing Stakeholder Expectations, Directing and Managing the Project while assuring Quality. [CO5] **Project Monitoring and Controlling Processes** - Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks. Integrated Change Control, Project Closing Process, Collecting Data, Visualizing Progress, Cost Monitoring review techniques, Project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts, Stages in Contract Placement, Typical Terms of a Contract, Contract Management and Acceptance. [CO5] **Quality Management and People Management**- Introduction, Understanding Behaviour, Organizational Behaviour, Selecting The Right Person for The Job, Motivation, The Oldman – Hackman Job Characteristics Model, working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. [CO5] Overview of project management tools for software.	22 Hours

Text Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill.
2. Royce, "Software Project Management: A Unified Framework, Pearson Education.

Reference Books:

1. Robert K. Wysocki, "Effective Software Project Management", Wiley
2. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
3. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.

Course Code: MCCA312C

Course Name: Data Mining and Business Intelligence

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective-I
Total marks: 100	

Prerequisite: - NA

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Highlight the need of Data Warehousing & Mining
CO2	Differentiate between the Transactional and Analytical data models.
CO3	Identify the real life applications where data mining can be applied.
CO4	Apply different data mining algorithms on wide range of data sets.
CO5	Comment on latest tools for data mining and big data analysis

Detailed contents	
Part A **Introduction:** **R**eporting and Analysing data, Raw data to valuable information-Lifecycle of Data, The building Blocks: Defining Features – Data Warehouses (DW) and Data Marts - Overview of the components – Metadata, Need, Basic elements, trends. Business Intelligence (BI) Definitions and Concepts, BI Process and Technology, BI Roles and Responsibilities. [CO1] **The Architecture of BI and DW:** BI and DW architectures and its types, Relation between BI and DW - OLAP and OLTP definition and its differences, Dimensional analysis: Drill-down and roll-up – slice and dice or rotation, schemas: Stars, snowflakes and fact constellations. [CO2]	

Introduction to data mining (DM) and Data Preprocessing: Motivation for Data Mining, Data Mining Definition, and Functionalities, Classification of DM Systems - DM task and its applications, Integration of a Data, KDD Process, Steps of pre-processing data - Data cleaning: Missing Values, Noisy Data - Data, Integration, and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression. [CO3]	24 Hours
Part B **Concept Description and Association Rule Mining:** Introduction, Data Generalization and summarization-based characterization, Association Rule Mining; Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm **Classification and Prediction:** Introduction,Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression **Data Mining for Business Intelligence Applications:** Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., [CO3] [CO4] **Introdcution to Advance Topics** Clustering, Spatial mining, web mining, text mining, Data Analytics Life Cycle: Big data Business Analytics, State of the practice in analytics role of data scientists, Hadoop architecture. [CO5]	20 Hours

Text Books:

1. J. Han, M. Kamber, "Data Mining Concepts and Techniques"
2. Arun K. Pujari, "Data Mining Techniques".
3. M. Kantardzic, "Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.

Reference Books:

1. PaulrajPonnian, "Data Warehousing Fundamentals", John Willey.
2. G. Shmueli, N.R. Patel, P.C. Bruce, "Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner", Wiley India.

Course Code: MCCA313C

Course Name : Enterprise Resource Planning

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective-I
Total marks: 100	

Prerequisite: - NA

Co requisite: -NA-

Additional material required in ESE: -NA-

Students will be able to:

CO#	Course outcomes
CO1	Define ERP & Related Technologies
CO2	Evaluate different types of ERP functional modules.
CO3	Explain Implementation Strategies of ERP
CO4	Consider the latest trends and domains of ERP.
CO5	Analyze various case studies related to ERP implementation

Detailed contents	Contact hours
Part A **Basic ERP Concepts:** Enterprise-An overview, Benefits & Risk, Evolution and Structure, Conceptual Model of ERP. [CO1] **ERP & Related Technologies:** Business Process Reengineering (BPR), Data Warehousing and Data Mining, OLAP, Product Life Cycle Management, Supply Chain management, CRM. [CO1] **ERP Functional Module:** Introduction, Finance, Manufacturing, Human Resource, Plant maintenance, Material Management, Integration of ERP, Supply Chain and Customer Relationship Application. [CO2]	22 Hours

	22 Hours
Part B **ERP Implementation:** Implementation Challenges / Strategies / Methodologies, ERP Project Teams, Vendors and Consultants, Dealing with employee resistance, Training and Education, data migration, Project Management and monitoring. [CO3] **Strategic Grid:** Useful guidelines for ERP Implementations. **Post Implementation :** Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Calculation ofROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators. **Emerging Trends on ERP**: Technologies in ERP Systems and Extended ERP, ERP Market Place and Dynamics, Future Directives in ERP; ERP E Commerce & E – Governance: Concept, frame work, area of application like public sector, service industry. [CO4]	

Reference Books:

1. S Sadagopan, "ERP A Managerial Prospective" TMH
2. Rahul V. Altekar "Enterprise wide Resource Planning" , TMH
3. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology
4. Sandoe, Corbitt, and Boykin, "Enterprise Integration", John Wiley, ©2001, ISBN 0-471-35993-9
5. Motiwalla and Thompson, "Enterprise Systems For Management", Pearson/Prentice Hall 2011

Course Code: MCCA314C
Course Name: Mobile Application Development

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours

Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective II
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Define framework of mobile application development
CO2	recognize the building blocks of mobile computing
CO3	check the mobile applications and learn various testing strategies
CO4	evaluate development environment of different operating systems for mobile application development.
CO5	Write programs for basic mobile applications

Detailed contents	Contact hours
Part A **Introduction**: Mobile Applications –Characteristics and Benefits – Frameworks and Tools, Types, Application Model. Profiles of Mobile devices.[CO1] **Building Blocks of Mobile Applications:** User Interface Designing, Layout, User Interface elements, Functionality based user interface, Naïve Data Handling, Sprucing up Mobile applications. [CO2] **Testing Mobile Applications:** Debugging Applications, Testing Strategies, Test Automation of Applications. [CO3]	22 Hours

	22 Hours
Part B **Mobile Operating System --**Introduction to Mobile Operating Systems and why they are needed, Open Platforms, Mobile OS Features, Symbian, BlackBerry, Android, iOS, Windows, Tizen, Ubuntu, etc. [CO4] **Android programming:** Android toolkit, Components of an Android application, Android Software Development using Eclipse – Concepts, Terminology, Views and Perspectives, memory management, communication protocols, application development methods, deployment. [CO5] **IOS:** Development environment, iOS Layers, Architecture, User Interface tool kit interfaces, Event handling, Graphics services, Layer Animation,asiciPhone Styling, Advanced iPhone Styling. [CO5]	

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Text Books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition: I

2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.

Reference Books:

1. ZigurdMednieks, L. Dornin, G. Blake Meike, M. Nakamura," Programming Andriod, 1st Edition, O'Relly Publication, 2011.

2. A. Allan" Learning iPhone Programming", 1st Edition, O'Relly Publication, 2010.

3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons.

4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS.

Shaheed Bhagat Singh State University
Master of Computer Applications (MCA)

Course Code: MCCA317C
Course Name: Mobile Application Development Laboratory

Program: MCA	**L**: 0**T**:0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective-II
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO1	Prepare environment for coding and running mobile applications
CO2	Develop mobile applications using GUI and Layouts
CO3	Develop mobile applications for different mobile operating systems.
CO4	Test Mobile Applications
CO5	Implement database connectivity with mobile applications.

List of Assignments	
Sr. No.	Assignments
1	Using emulator to deploy and run mobile apps
2	Create an Android application that shows Hello + name of the user and run it on an emulator.
3	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
4	Develop an ANDRIOD application that uses GUI components, Font and Colors.
5	Write an application that draws basic graphical primitives on the screen.
	Develop an application that uses Layout Managers and event listeners.
7	Create and Login application. On successful login, open browser with any URL.
8	Testing mobile app - unit testing, black box testing and test automation.
9	Create an iOS application that can play audio and video files.
10	Write an iOS application that creates alarm clock.
11	Devise an iOS application that draws basic graphical primitives (rectangle, circle) on the screen.
12	Build an iOS mobile application that create, save, update and delete data in a database.

Text Books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition: I

2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.

Reference Books:

1. ZigurdMednieks, L. Dornin, G. Blake Meike, M. Nakamura," Programming Andriod, 1st Edition, O'Relly Publication, 2011.

2. A. Allan" Learning iPhone Programming", 1st Edition, O'Relly Publication, 2010.

3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons.

4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS.

Course Code: MCCA316C
Course Name: Software Testing & Quality Assurance

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 60	**Elective status:** Elective-II
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understanding various software testing and quality assurance techniques for software development.
CO2	Create test strategies, design test cases, test strategies and their execution.
CO3	Identify various risks involved with software projects and build risk management
CO4	Understanding software quality assurance techniques and software quality assurance metrics
CO5	Understand Risk Management and Change Management

Detailed contents	Contact hours
Part A **Software Testing:** Testing, Verification and Validation, Test Strategies for Conventional and Object Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha and Beta Testing, System Testing, Recovery Testing, Security Testing, Stress Testing, Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies. [CO1] **Testing Techniques:** Software Testing Fundamentals, Black Box and White Box Testing, Basis Path Testing, Flow Graph Notation, Independent Program Paths, Graph Matrices, Control Structure Testing, Condition Testing, Data Flow Testing, Loop Testing, Graph Based Testing Methods, Equivalence Partitioning, [CO2]	26 Hours

Object Oriented Testing Methods: Applicability of Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-Based Testing, Scenario-Based Testing, Random Testing and Partition Testing for Classes, InterClass Test Case Design. **Testing Process and Specialized Systems Testing:** Test Plan Development, Requirement Phase, Design Phase and Program Phase Testing, Testing Client/Server Systems, Testing Web based Systems, Testing Off the-Shelf Software, Testing in Multiplatform Environment, Testing for Real Time Systems, Testing Security. [CO2]	
Part B **Software Quality Assurance Concepts and Standards:** Quality Concepts, Quality Control, Software Quality Attributes, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, Review Guidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000,ISO 9001:2000, ISO 9126 Quality Factors, CMM, CMMI, PCMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics. [CO1] [CO4] **Risk Management and Change Management:** Software Risks, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan, Software Configuration Management, Baselines, Software Configuration Items, SCM Process: Version Control, Change Control, Configuration Audit, Configuration Management for Web Engineering. [CO3] [CO5]	18 Hours

Text Books:

1. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education
2. Software Testing Techniques, Boris Beizer, Dream Tech Press.

Reference Books:

1. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014.
2. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India.
3. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press Walker Royce, Software Project Management: A Unified Frame Work, Pearson Education.

Course Code: MCCA319C
Course Name: Software Testing & Quality Assurance Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 40	**Elective status:** Elective-II
Total Marks : 100	

Prerequisite: Software Engineering (PGCA1912)
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand various approaches of software testing and quality assurance for software development.
CO2	Create test strategies, design test cases, prioritize and execute them.
CO3	Identify various risks involved with software projects and build risk management
CO4	Plan and execute software management and configuration activities.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

1.	Introduction to Test Cases, How to create a simple test case and record it in the excel file.
2.	Developing Login functionality and testing them manually and storing the data in the sheet.
3.	Testing the registration functionality
4.	Testing flight reservation system and recording test cases
5.	Testing the date field scenario programmatically and recording test cases.
6.	Taking scenario of product description functionality in ecommerce website.
7.	Taking a scenario of payment functionality and order history in ecommerce website.
8.	Practicing the data flow testing taking some another logic and implying path testing
9.	Taking up path testing
10.	Developing a logical code to test boundary value exemptions
11.	Create an image upload functionality and make their test cases
12.	Teams will make HTML CSS design templates in hours and perform load and performance testing
13.	Developing applications to automate basis path testing.
14.	Exposure to automated testing tools such as Rational test manager, Selennium, Load runner or any other similar tools

Text Books:

1. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education
2. Software Testing Techniques, Boris Beizer, Dream Tech Press.

Reference Books:

1. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014.
2. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India.
3. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press Walker Royce, Software Project Management: A Unified Frame Work, Pearson Education.

Course Code: MCCA401C
Course Name: Machine Learning and Data Analytics using Python

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand Machine Learning fundamentals
CO2	Explain types of machine learning i.e. supervised, unsupervised learning, reinforcement learning
CO3	Elaborate classification and clustering techniques
CO4	Data analysis using Python libraries, Numpy, Pandas
CO5	Visualize data using Python matplotlib library

Detailed contents	Contact hours
Part A	22 Hours
Machine Learning: Introduction, supervised, unsupervised, reinforcement learning.[CO1] [CO2]	
Regression: Linear Regression, linear classification, logistic regression.	
Clustering: K nearest neighbour, decision trees, Random forest. [CO3]	
Classification: Naïve Bayes, principal component analysis, Introduction to neural networks. [CO3]	
Part B	22 Hours
Introduction to Python Programming: Data types, operators, control structures, functions, modules.	
Numpy: Introduction to numpy, arrays, array indexing, operations. [CO4]	
Pandas: Introduction to pandas, series, group by, DataFrames, missing data, merging, joining, concatenating, operations, data input and output. [CO4]	
Matplotlib: Plotting, markers, line, labels, grid, subplot, scatter, bars, histograms, pie charts. [CO5]	

Text Books:

1. Machine Learning using Python, M Pradhan, U Dinesh Kumar, Wiley, 2015.
2. Introduction to Machine Learning with Python: A Guide for Dta Scientists, Andreas Muller, O'Reilly, 2016.
3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Willian Mckinney, O'Reilly, 2017.

Reference Books:

1. Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance, Puneet Mathur, Apress, 2019.
2. Python for Data Science For Dummies, John Paul, Luca, Massron, Wiley, 2019.

Course Code: MCCA402C
Course Name: Advanced Web Technologies

Program: MCA	L: 4 T: 0 P: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA- Co requisite: -NA-

Additional material required in ESE: -NA- Course Outcomes: Students will be able to:

| CO#	Course outcomes
CO1	Explain client-side and server-side programming.
CO2	Discuss web data and XML document handling.
CO3	Describe the role of AJAX.
CO4	Develop a dynamic webpage by the use of java PHP and MySQL.
CO5	Apply basic CRUD database operations in a Dynamic Website.
CO6	Discuss basic web services and their development.

Detailed contents	Contact
Part A **PHP**: Server-side web scripting, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors/ problems. [CO1] **Advanced PHP and MySQL**: PHP/MySQL Functions, Displaying queries in tables, Introduction to PHP OOPs concepts, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, Type and Type Conversions, E-Mail. [CO4] **Introduction to Web Services:** Use of Web Services, Types of Web Services, Introduction to Content Management System CMS (Types, Usages, Benefits). [CO2] [CO6]	22 Hours
Part B **XML**: Introduction to XML, XML Basics, XML Syntax and Editors, documents, Elements, Attributes. Creating XML documents. [CO2] **Ajax** : Introduction and Use of Ajax in Website. [CO3] **jQuery** : Introduction, jQuery UI: Date picker, auto complete, tooltip, accordion, retrieving page content, manipulating page content, working with events. [CO5] **Introduction to Bootstrap :** Components of Bootstrap **Introduction to Node.js**: Node Package Manager (NPM), Node.js Webserver – Server and Clients. **React**: Introduction to ReactJS, Environment Setup, JSX, Components, State, Props, Validating Props, Component API, Component Life Cycle, Forms, Events	22 Hours

Text Books:

1. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
2. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
3. W. Jason Gilmore,"Beginning PHP and MySQL: From Novice to Professional", Apress.
4. "Learning PHP, MySQL, JavaScript, CSS and HTML 5", Robin Nixon, O'Reilly publication
5. Web Technologies, Black Book, dreamtech Press
6. Alex Young, "Node.js in Action", 2ed, Bradley Meck

Reference Books:
1. Jesus Caspagnetto, "Professional PHP Programming", Wrox Publication.
2. P.J. Deitel& H.M. Deitel, "Internet and World Wide Web How to program", Pearson
3. Harwani, "Developing Web Applications in PHP and AJAX", McGrawHill
4. Ralph Moseley and M. T. Savaliya, "Developing Web Applications", Wiley-India
5. HTML 5, Black Book, Dreamtech Press
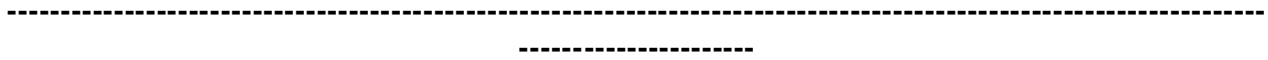
Course Code: MCCA403C

Course Name: Machine Learning and Data Analytics using Python Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Develop knowledge of machine learning models
CO2	Implement machine learning algorithms for classification and clustering problems
CO3	Train and evaluate machine learning models using benchmark datasets
CO4	Application of machine learning method for solving real-world problems

Instructions:
1. **Students may develop the assignments in Python.**
2. **Standard data sets or assumed data sets may be used for developing ML programs.**

Assignments:

1.	Design and evaluate a data model using Linear Regression.
2.	Design and evaluate a data model using Logistic Regression.
3.	Design and evaluate a data model using KNN.
4.	Design and evaluate a data model using K Means Clustering.
5.	Design and evaluate a data model using SVM.
6.	Design and evaluate a data model using PCA.
7.	Design and evaluate a data model using Decision Trees.
8.	Design and evaluate a data model using Random Forest.
9.	Compare the performance of all the above ML techniques on a similar data set using matplotlib.

Reference Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.
2. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: MCCA404C
Course Name: Advanced Web Technologies Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical**: Practical
External max. marks: 40	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: --

Co requisite: --

Additional material required in ESE:
 ➢ Install the following on local machine
   • Apache web server OR Tomcat application server locally
   • Install MySQL
   • PHP and configure it to work with Apache web server and MySQL

Course Outcomes: After studying this course, students will be able to:

CO#	Cour
CO1	Understand the advance concepts of website development.
CO2	Design dynamic web sites.
CO3	Implement database programming for web applications
CO4	Implement jQuery methods, AJAX, Bootstrap and REACT
CO5	Perform basic CRUD operations.
CO6	Develop market ready website, to be used by clients.

Instructions: Instructor can increase/decrease the experiments as per the requirement. **Assignments:** All the Practical Assignments need to be carried on specific applications. (Example: Inventory Management System, Bus/Airline/Railway Reservation System, Student Management System etc.)

	Practice Programs with PHP
1	PHP Code to display today's date in dd-mm-yyyy format.
2	PHP Code to check if number is prime or not.
3	PHP Code to print first 10 Fibonacci Numbers.
4	PHP Code to read data from txt file and display it in html table (the file contains info in format Name: Password: Email)
5	PHP Script for login authentication. Design an HTML form which takes username and password from user and validate against stored username and password in file.
6.	PHP Script for storing and retrieving user information from MySql table. ⬥ Design A HTML page which takes Name, Address, Email and Mobile No. From user (register.php) ⬥ Store this data in MySql database / text file. ⬥ Next page display all user in html table using PHP (display.php)
7.	PHP Script for user authentication using PHP-MYSQL. Use session for storing username.
8.	Create HTML page for chosen application that contain textbox, submit / reset button. Write php program to display this information and also store into text file.
9.	Create XML documents for chosen application and validate using DTD and schema. Also render the content of XML document using XSL. Scenarios include ⬥ XML document must have attributes and elements so that they can be validated against DTD/Schema. ⬥ Check the data types of variables declared in XML document using Schema. ⬥ Display the details of data contained in XML document in a table using XSL.
10.	Embed the JQuery features for the application chosen. Perform the Scenarios using JQUERY ready function In login form, define username and password constraints and ensure that the credentials follow them. ⬥ In registration form, username must be of atleast 6 characters. Password must be of atleast 8 characters and follow password constraints. Password and confirm password fields must match with each other. E-mail id must be of the form "yourname@domain.com". Mobile number must be of 10 digits only and starting digit must be any number from 6-9 etc… ⬥ Use the get and post methods for server side communication.
11.	Modify the specific web applications to use AJAX to show the result on the same page.
12.	Enhance functionality of the specific web applications using BOOTSTRAP
13.	Create a responsive Photo Gallery in BOOTSTRAP

14.	Suppose you have a list of Students having Student's Name, Roll Number, Marks in five subjects, Show this list in a responsive table in BOOTSTRAP
15.	Modify your answer for above question with PHP and MYSQL database and Perform CRUD operations with AJAX
16.	Build a Password Strength Check App with JQuery. You can use AJAX for form validation and add an alert when the user enters a weak password.
17.	Build a Registration Form and Validate it with JQuery. Registration Form must have at least 10 elements.
18.	Design a Sign In, Sign Up and Forgot Password Page with BOOTSTRAP. Use PHP and MYSQL to store Sign Up data in Database.
19.	Create a Star Rating System in JQuery.
20.	Create a simple To-do list Application with REACT
21.	Create a Calculator with REACT
22.	Create a Photo Gallery with REACT. Also implement search operation
23.	How can you create a Portfolio App with Node.js?
24.	Create a simple Shopping Cart with REACT and Node.js
25.	Modify your Shipping Cart with JQuery, JSON and AJAX functionality.

Reference Books:

1. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
2. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
3. W. Jason Gilmore,"Beginning PHP and MySQL: From Novice to Professional", Apress.
4. Learning PHP, MySQL, JavaScript, CSS and HTML 5, Robin Nixon, O'Reilly publication

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- Course Code: MCCA411C
Course Name: Cloud Computing

Program:MCA	**L:**4 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:**
Internal max. marks: 40	**Duration of end semester exam (ESE):**
External max. marks:60	**Elective status: core/elective** Elective-III
Total marks:100	

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Understanding the basic terminology and usage of cloud computing in emerging IT world.
CO2	Understanding the concepts of migration to a cloud solution for specific applications.
CO3	Understanding the virtualization concepts in cloud computing.
CO4	Understanding the cloud resources management with security concerns
CO5	Practical execution of cloud services provided by various industries.

Detailed contents	Contact hours
Part A **Overview of Computing Paradigm:** Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing.[CO1] **Introduction to Cloud Computing:** Vision of Cloud Computing, Defining a Cloud, Cloud Reference Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing. [CO1] **Migrating into a Cloud:** Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud. [CO2] **Virtualization:** Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples- Xen, VMware, Microsoft Hyper-V. [CO3] **Capacity Planning:** Introduction, Defining Baseline and Metrics- Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.	22 hours
Part B **SLA Management in Cloud Computing:** Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management. **Securing Cloud services:** Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. [CO4]	22 hours

Cloud Storage: Provisioning Cloud Storage, Virtual storage containers, Cloud Storage Interoperability (CDMI, OCCI), Database Storage, Resource Management, [CO4] **Advance Topics in Cloud:**Energy Efficiency in cloud, Market Oriented Cloud Computing, Federated Cloud Computing, Mobile Cloud Computing, Fog computing, BigData Analytics, Basics of IoT. **Cloud Platforms in Industry:** Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance. [CO5]	

Text Books:
1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India,Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3,New Delhi, India, 2011**.**
3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6,New Delhi, India, 2011

Reference Books:
1. Cloud Computing For Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

E Books/ Online learning material:
1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in:Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339–342.
2. P.Mell and T. Grance, "The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

Course Code: MCCA415C
Course Name: Cloud Computing Laboratory

Program: MCA	**L:**0 **T:**0 **P:**4
Branch: Computer Applications	**Credits:** 2
Semester:4th	**Contact hours:**4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:**
Internal max. marks: 60	**Duration of end semester exam (ESE):** -
External max. marks: 40	**Elective status: core/elective** Elective-III
Total marks: 100	

Prerequisite: Working Knowledge of Linux Operating system

Co requisite:

Additional material required in ESE:

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Learn the use of cloud computing tools offered by industry leaders.
CO2	Develop and deploy cloud applications using popular cloud platforms.
CO3	Configuration of the virtual machines on the cloud and building of a private cloud.
CO4	Implement cloud storage management tasks.
CO5	Develop private cloud

Sr. No.	Experiment Name
1.	Enlist various companies in cloud business and the corresponding services provided by them and tag them under SaaS , PaaS & IaaS.
2.	Create a warehouse application using tools supplied by any SaaS provider.
3.	Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S. Learn creation, migration, cloning and managing of virtual machines.
4.	Using public cloud service providers tools for exploring the usage of IaaS, PaaS and SaaS cloud services.
5.	Interact with Cloud Storage and conduct typical management tasks such as bucket creation, file transfers, Access Control Lists (ACL) permissions and Identity and Access Management (IAM) configuration.
6.	Setting up a private cloud using open source tools (Eucalyptus/Open Stack etc.).

Reference Books:

1. Cloud Computing For Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights Into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

Course Code: MCCA412C
Course Name: Digital Image Processing

Program: MCA	L:4 T:0 P:0
Branch: Computer Applications	Credits: 4
Semester: 4th	Contact hours: 44 hours
Theory/Practical: Theory	Percentage of numerical/design problems: --
Internal max. marks:40	Duration of end semester exam (ESE): 3hrs
External max. marks:60	Elective status: Elective-III
Total marks: 100	

Prerequisite: -Student must have knowledge about Computer Graphics.

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the need of various image transforms along with properties
CO2	Discuss different techniques employed for the enhancement of images
CO3	illustrate the rapid advances in Machine vision
CO4	Analyze images in multi resolution environment
CO5	Evaluate image compression techniques

Detailed contents	Contact
Part A **Introduction:** Fundamental steps in Digital Image Processing, Components of an image processing system, Image sampling and quantization, Color models **Digital Image Processing Operations:** Pixel relationships and distance metrics -Image coordinate system, Image topology, Connectivity, Relations, Distance measures. Classification of image processing Operations - Arithmetic, Logical, Geometrical (Translation, Scaling, Zooming, Linear Interpolation, Mirror or Reflection, Shearing, Rotation, Affine and Inverse transformation) Operations, Image interpolation Techniques (Downsampling and upsampling), Set operations, Statistical operations, Convolution and Correlation operations. [CO1] **Image Enhancement in Spatial Domain:** Image enhancement point operations- Linear and non-linear functions, Piecewise linear functions, Histogram processing. Spatial filtering - basics of filtering in the spatial domain, Vector representation, Smoothing linear and non-linear filters, sharpening filters. [CO2] **Image Enhancement in Frequency Domain:** Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters. [CO2]	24 Hours

Part B	
Image Restoration: A model of the image degradation/restoration process, Noise models, Noise filters, Degradation function. [CO3] **Multiresolution Analysis:** Wavelet analysis, Continuous wavelet transform, Discrete wavelet transform, Wavelet decomposition and reconstruction in two dimensions, Wavelet packet analysis, Wavelet based image denoising. [CO4] **Image Compression:** Image compression model, Compression measures, Compression algorithm and its types (Entropy, Predictive, Transform and layered coding), Types of redundancy (Coding, Inter-pixel, Psycho-visual and Chromatic), Lossless compression algorithms – Run-length, Huffman, Bit-plane, Arithmetic, Predictive coding. Lossy compression algorithms – Lossy predictive, Block transform coding. [CO5] **Image Segmentation:** Classification of image segmentation algorithms, Point, Line and Edge detection, Hough transforms, Corner detection, Global thresholding, Otsu's method, Multivariable thresholding, Region-based segmentation, Watershed segmentation,	

Text Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 2013.

2. S. Sridhar, "Digital Image Processing", Oxford University Press, 2011.

Reference Books:

1. M. Sonka, V. Hlavac and Roger Boyle, " Image Processing, Analysis and Machine Vision", Thomas Learning, 2007

2. K. R. Castleman, "Digital Signal Processing", Pearson Education, 2007.

Course Code: MCCA416C

Course Name: Digital Image Processing Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours:**4 hours per week
Internal max. marks: 60	**Theory/Practical**: Practical
External max. marks: 40	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Elective-III

Prerequisite: Students must have the knowledge of computer graphics.
Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Implement the various operations which can be performed on images.
CO2	Apply filters on images as per the requirement
CO3	Implement different techniques employed for the enhancement of images
CO4	Implement image compression
CO5	Develop an Image Processing Application

Instructions: For implementation, software such as Python/SciLab/MATLAB or any other image processing software can be used and instructor may increase/decrease the experiments as per the requirement.

Sr	Assignments
1.	Installation of image processing software and use of basic image processing commands.
2.	Generation of lines, array, matrix and image
3.	Reading and displaying images in different formats using different color models
4.	Converting color images into monochrome images
5.	Displaying of image Histogram
6.	Image color enhancements using pseudo coloring techniques
7.	Image restoration techniques.
8.	Application of image processing operations
9.	Point, Line, and Edge Detections in images
10.	Boundary Detections in images
11.	Color image processing
12.	Wavelet transforms.
13.	Image compression techniques
14.	A minor project based on above taught image processing techniques.

Reference Books:
1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 2013.
2.

Course Code: MCCA413C
Course Name: NLP and Speech Recognition

Program: MCA	**L**: 4 **T**: 0 **P**: 0	
Branch: Computer Applications	**Credits:** 4	
Semester: 4th	**Contact hours:** 44 hours	
Theory/Practical: Theory	**Percentage of numerical/design problems: --**	
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs	
External max. marks: 60	**Elective status:** Elective-III	
Total marks: 100		

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Examine the fundamental concepts of natural language processing
CO2	Describe text normalization, use of edit distance, and regular expressions
CO3	Implement Naïve bayes and sentiment classification algorithms
CO4	Familiarize with chatbots and phonetics
CO5	Describe the concept of speech recognition and text to speech conversion.

Detailed contents	Contact hours
Part A **Introduction to Natural Language Processing**[CO1] **Regular Expressions, Text Normalization, Edit Distance:** Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance. [CO2] **N-gram Language Models:** N-Grams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, Huge Language Models and Stupid Backoff, Advanced: Perplexity's Relation to Entropy **Naive Bayes and Sentiment Classification:** Naive Bayes Classifiers, Training the Naive Bayes Classifier, Optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation, Statistical Significance Testing, Avoiding Harms in Classification. [CO3] **Logistic Regression:** Classification: the sigmoid, Learning in Logistic Regression, The cross-entropy loss function, Gradient Descent, Regularization, Multinomial logistic regression, Interpreting models, Advanced: Deriving the Gradient Equation	22 Hours
Part B **Chatbots & Dialogue Systems:** Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State	22 Hours

Architecture, Evaluating Dialogue Systems, Dialogue System Design. **[CO4]**	

Phonetics: Speech Sounds and Phonetic Transcription, Contents, Articulatory Phonetics, Prosody, Acoustic Phonetics and Signals, Phonetic Resources

Automatic Speech Recognition and Text-to-Speech: The Automatic Speech Recognition Task, Feature Extraction for ASR: Log Mel Spectrum, Speech Recognition Architecture, CTC, ASR Evaluation: Word Error Rate, TTS, Other Speech Tasks.**[CO5]**

Text Books:

1. Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Daniel Jurafsky, James H. Martin, Pearson, 2020
2. The Oxford Handbook of Computational Linguistic, Ruslan Mitkov, Oxford
3. Taming Text, Grant Ingersoll, Thomas Morton and Drew Farris, Manning

Reference Books:

1. Natural Language Processing with Python by Steven Bird, Ewan Klein and Edward Loper, O'Reilly, 2009

Course Code: MCCA417C
Course Name: NLP and Speech Recognition Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective-III
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Develop knowledge of various learning models of data.
CO2	Analyze performance of various learning algorithms.
CO3	assess models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Instructions:

1. **Students may develop the assignments in Python.**
2. **Standard data sets or assumed data sets may be used for developing ML programs.**

Assignments:

1.	Write a Program for Word Analysis.
2.	Write a Program for Word Generation.
3.	Write a program to implement Morphology.
4.	Write a Program to implement N-Grams.
5.	Write a Program to implement N-Grams Smoothing.
6.	Write a Program to implement POS Tagging: Hidden Markov Model.
7.	Write a Program to implement POS Tagging: Viterbi Decoding
8.	Design and evaluate a data model using Linear Regression.
9.	Design and evaluate a data model using Logistic Regression.
10.	Design a vocabulary of about 20 words. Choose words with a variety of segmental structure and length: place names or animal names for example. Add in a few minimal pairs.

Reference Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.
2. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: MCCA414C
Course Name: IOT & Blockchain Technology

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: --
Internal max. marks:40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective-III
Total marks: 100	

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the terminology and enabling technologies of IoT and Blockchain
CO2	Identify various element of IoT.
CO3	Explain the steps involved in IoT system design methodology
CO4	Describe the working of bit coin crypto currency
CO5	Learn domain specific applications of IoT and Blockchain

Detailed contents	Contact hours
Part A **Introduction to Internet of Things (IoT):** Definitions & Characteristics of IoT, Physical Design of IoT-Things in IoT, Protocols, Logical Design of Functional Blocks, Communication Models, Communication APIs. [CO1] **Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates. [CO1] **Elements of IoT :** Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- familiarity with API's for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP. Solution Framework for IoT applications. [CO2] **Domain Specific IoTs**: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle. [CO3]	24 Hours
Part B **Concept of Blockchain**: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to	20 Hours

Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain. [CO1]

Bitcoin and Blockchain: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. [CO4]

Enterprise Application of Blockchain: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade — Trade Finance Network, Supply Chain Financing, Identity on Blockchain. [CO5]

Text Books:
1. ArshdeepBahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
2. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
3. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

Reference Books:
1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press).
2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
3. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.
4. Iran Bashir "Mastering Blockchain", Second Edition Paperback, 2018.
5. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.

Course Code: MCCA418C
Course Name: IOT & Blockchain Technology Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical**: Practical
External max. marks: 40	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Elective-III

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Learn IoT sensors and remotely monitor data and control devices.
CO2	Discuss real life IoT based projects.
CO3	Understand blockchain technology and develop blockchain based solutions.
CO4	Deploy IoT based blockchain applications for on-premise and cloud based architecture.
CO5	Make docker based application

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
3.	Interfacing Rain Sensing Automatic Wiper System
4.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
7.	Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to and from thingspeak cloud.
8.	Interfacing smoke sensor to give alert message to fire department.
9.	Install and understand Docker container, Node.js, Java and Hyperledger Fabric/ Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
10.	Create and deploy a blockchain network using Hyperledger Fabric SDK/Ethereum for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
11.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
12.	Develop an IOT asset tracking app using Blockchain. Use an IOT asset tracking device to improve a supply chain by using Blockchain, IOT devices and Node-RED

e-Resources:

1. GitHub repository.
2. IBM library for IoT.

Course Code: MCCA405C
Course Name: Research/Technical seminar

Program: MCA	**L**: 0 **T**: 0 **P**: 2		
Branch: Computer Applications	**Credits**: 1		
Semester: 4th	**Contact hours:** 2 hours per week		
Internal max. marks: 0	**Theory/Practical**: Practical		
External max. marks: 100	**Duration of End Semester Exam (ESE):** 3hrs		
Total marks: 100	**Elective status:**		

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Project:

Students may be encouraged to take up internship projects in industry or research/academic institutions.

Students may be offered software/hardware development or research oriented projects if taken in house.

Faculty members may offer project proposals from their side and students may choose from them.

Students may also submit project proposals not covered in the faculty provided list, which may be guided by the interested faculty members.

Co-guidance with external institutes/industry may also be allowed.

Same project ideas may be submitted by more than one student group, but may be unique at the implementation level, as per the judgment of the department.

Students may be encouraged to take up more innovative projects involving contemporary technologies, leading to research paper and/or patent publications.

Minor Projects from the previous semester may also be carrying forwarded with significant up gradations.

Technical seminar:

Industry seminars are suggested to enable the students of MCA to appreciate the software developments which are going on in industries in India. These seminars will help the students to face interviews with some confidence. The students should attend these and submit a report. The following points are listed to enable the college to organize these seminars.

1. Three to four organizations (Industry, Public sector organizations, Govt. organizations) are requested to present a detailed case study of one or many applications in their organization.

2. Presentation covers in detail all aspects of a project from conception to implementation and maintenance. Design is discussed to cover all factor that influenced the design. Planned and achieved benefits of the application are also stressed.

3. In order that the students take the presentations seriously, groups of students are assigned to prepare a detailed synopsis of each presentation, copies of which are distributed to others.

4. One session could be a survey of new applications in the Indian environment during the past year, as ascertained from a survey of news paper articles. This is to be done by a group of students.

5. College can invite potential employers to participate in the inauguration- and valediction of the seminar so that the efforts of the college get noticed by employers.

6. It is neither necessary nor possible to have an examination on the seminar. Idea is that the motivated students get an opportunity to seek answers to questions on worthwhile computerization on our economy.

CourseCode: MCCA406C
Course Name: Project

Program: MCA	**L**: 0 **T**: 0 **P**: 8
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 8 hours per week
Internal max. marks: 180	**Theory/Practical**: Practical
External max. marks: 120	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 300	**Elective status:**

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Annexure A

OBJECTIVE

The objective of the project course is to help the student develop ability to apply multi-disciplinary concepts, tools and techniques to analyze and logically approach the organizational problems.

PROJECTPROPOSAL EVALUATION:

The project proposal/Synopsis will be submitted within 2 weeks from start of semester and evaluated by the panel of three teachers in the presence of student, who will give the presentation to the panel.

In case of non-approval of the Synopsis the comments/suggestions for reformulating the Synopsis will be communicated to the student.In such case, the revised Synopsis should be submitted within 7 days, which shall be evaluated on similar guidelines.

Then after period of 1 Month Progress report 1 has been evaluated by Guide on the basis of following:

1. Problem Definition
2. Need & Scope of the Study
3. Methodology & Objectives
4. Data Analysis & Findings

Then after period of 2 Month Progress report 2 has been evaluated by Guide on the basis of following:

1. Testing & Implementations
2. Suggestions and Conclusions
3. Overall Report Writing & Layout

PROJECTPRE-SUBMISSION:

After approval of the Synopsis, student shall complete their projects and submit the completed Project Report (Spiral bound) for final internal evaluation before 2ndMST.

The guidelines for project report are as follows:

- The length of the report may be about 60 to 8 0 double spaced typed pages not exceeding approximately 18,000words (excluding appendices and exhibits). However, rational variation on either side is permissible.

- The Project Report may have the following:
    - Cover Page–must have the Title of the Project, Name & logo of college/ university, Name and University Roll No of the Student and the Name of the Guide, along with the designation and department.
    - Detailed table of contents with page nos.
    - All pages of the Project Report must be numbered as reflected in the table of contents.
    - Project Proposal, properly bound in the project and not just stapled. Please note that project with stapled Proposal will not be accepted.
    - Certificate of originality-duly signed by the student and the guide with dates.
    - Introduction to the Project and Review of Literature along with brief details of the organization/s understudy.
    - Rationale
    - Statement of problem
    - Objectives of the Project
    - Scope of the study
    - Research Methodology
        - Research Design
        - Nature and Source of data/information collected
        - Sample and Sampling method with rationale
    - Details of the tools:
        - The Questionnaire and other methods used and their purpose

- Reliability and Validity of the tools used
- Administration of tools and techniques
- Data collection
- Data Handling, Statistical tools used for Data Analysis

○ Data Interpretation and Findings
○ Recommendations
○ Summary and Conclusion
○ Limitations of the Project
○ Direction for further research (optional)
○ Reference/Bibliography
○ Annexures/Appendices (Questionnaireusedetc.)

 Note: Research Methodology of the Project Report must have elaborate detail of all the components of the methodology.

The spiral bound project report will be evaluated by the panel of three teachers before second MST in presence of student, who will give the presentation to the panel before second MST.

In case of non-approval of the final project report,the comments/suggestions for revising the project report will be communicated to the student. In such case, the revised project report should be submitted within 7 days, which shall be evaluated on similar guidelines.

SUBMISSION OF FINAL PROJECT REPORT:

After in corporating changes, if any, pointed out during internal evaluation, the final Project Report in Hard Bound form(3copies) shall be submitted by the student at least 3 working days before final viva voce. After signing of certificate by student and supervisor,one copy will be retained by the supervisor, second copy by the student and third copy shall be produced at the time of viva-voce, which shall be maintained by the department as record.

Note:
1. **Wherever it is felt that there is not sufficient time to complete the project after approval of Synopsis, the phases of Project till "Project Proposal Evaluation" may be completed in third semester at department level.**
2. **Minor Projects from the previous semester may also be carrying forwarded with significant up gradations with the consent of HOD.**
3. **For further details on references, bibliography and formatting of the report, you may refer the Guidelines for Project Report.**

EVALUATIONCRITERIAFORPROJECTREPORT(MCA-PGCA1962-22)

S.No.	Name	RollNo. &Date of Presentation	Synopsis	Problem Definition /Need& Scope of the Study	Methodology & Objectives	Data Analysis & Findings	Testing and Implement ation	Suggesti ons &Conclu sion	Overall Report Writing &Layo ut	Total Earned Marks out of (170)	Signature ofthe Evaluator with Date	Attendance Marks(in accordance to the criteria)	Total Earned Marks out of (180)
				Progress Report 1			Progress Report 2						
			60	20	15	15	20	20	20	160		10	180
1													
2													
3													

Note:

1) Total marks of "Project Report(MCAPGCA1962-22)" = 180
2) Attendance Marks (from a total of 5 marks) to be given on the basis of percentage of lectures attended of MCA during the academic term as per the following criteria:
   i. Above75%=NIL
   ii. 76%- 80%=1
   iii. 81%- 85%=2
   iv 86%- 90%=3
   v 91%95%=4
   vi. 96% and above=5

Guidelines for Project Report

Project Report on

"PROJECTTITLE"

Submitted to

Logo of the Institute

SHAHEED BHAHGAT SINGH

STATE UNIVERSITY

FEROZEPUR

In partial fulfilment of the requirement for

the award of degree of

Master of Computer Applications(MCA)

Submitted by   **Supervisor**

Name of the Student

Name(Guide) University Roll no.

Designation

DEPARTMENT OF COMPUTER

APPLICATIONS

**NAME OF THE
INSTITUTE**

**NAME OF THE
CITY**

(Batch)

CERTIFICATE (On a Separate Page)

*Certificate of Project from Institute/Company/Industry shall be attached here with.

STUDENT DECLARATION (On a Separate Page)

I "(Student Name)" hereby declare thar I have under gone my Project at "(Institute /Industry Name)" from (Start date) to (end date). I have completed a research project titeled " (Project Title)" under the guidance of Mr./Mrs. (Name of Supervisor)

Further I   hereby confirm   that the work presented here in is genuine and original and has not been published elsewhere.

_____

(Student name and Signature)

FACULTYDECLARATION (On a Separate Page)

I hereby declare that the student Mr./Ms. Of MCA has undergone his/her Project under my periodic guidance on the Projet titled "(Project Title)"

Further I hereby declare that the student was periodically in touch with me during his/her training period and the work done by student is genuine &original.

_____

(Signature of
 Supervisor)

ACKNOWLEDGEMENT (On a Separate Page)

*Acknowledge the support and guidance provided to you by various persons during your
Project Training.

TABLE OFCONTENTS (On a Separate Page)

Certificate by Guide		ii
Student Declaration		iii
Faculty Declaration		iv
Abstract		V
Acknowledgment		V
CHAPTER NO.	**CHAPTER TITLE**	**PAGE NO.**
1	Synopsis	
2	Introduction to the Research Problem	
3	Need, Scope and Objectives of the Study	
4	Research Methodology	
5	Data Analysis and Interpretation	
6	Findings of the Study	
7	Testing and Implementation	
8	Conclusion, Suggestions &Recommendations of the Study	
References and Bibliography		
Appendix (Questionnaire, Glossary of Terms, Abbreviations, Documents, Performa, Financial statements, etc.)		

LIST OFTABLES

TABLE NO.	**TABLE TITLE**	**PAGE NO.**

LIST OF FIGURES

FIGURE NO.	**FIGURE TITLE**	**PAGE NO.**

General Guidelines for Layout and format

1. Paper Size mustbeA4andmarginsshouldbemaintainedonallpagesasfollows:**Leftmargin= 1.5" (wider for binding)Top, right &bottom margins =1"**

2. Use**TimesNewRoman**font,**12 point** size, for text. And **14 point** size for headings

3. Use**1.5**_linespacing_foralltext in the main body of the thesis.

4.   Reportshouldcontainpagenumbers(1,2,3….)startingfromIntroductionChapter.Preliminary pages should be numbered :i.,ii.,iii, iv,v,vi,etc. A page number should not be shown on the inside title page even though it is counted as i.

5. Page number should be placed at the **bottom-center of page**.

Imp Note:

1. Students are required to prepare two Hard Bound copies of their Project report to be submitted within 10 days ofcommencementof3[rd]Semester

2. Questionnaires in original to be retained by the students for the final presentation if required.

Guidelines on Faculty Guide-Student Interaction

1.   TheStudentisrequiredtobeinconstanttouchwiththeirFacultyGuidethroughemail,telephone, personal interactions etc.

2.   ItismandatoryforthestudenttoprovideaweeklyprogressreporttotheirFacultyGuidesforeach   week of their Project.

3.   TheTopicfortheProjectshouldbechoseninconsultationwiththeirFacultyguideand after their due approval.

4.   Same topics having any sort of duplicacy shall not be acceptable.

5.   InstitutewillbeconductingsurprisevisitsoftheorganizationwheretheStudentisundergoing Projectfromtimetotimeandanystudentsfoundtobeirregular/notattendingtheir Project then the Project report of the said student shall stand cancelled.

PreparingReferences/Bibliography

   While preparing the Bibliography, in case of website as a source, ensure that the date and the timing of accessing the website is mentioned along with.
   While preparing bibliography student must adopt the following method:

Article ina Magazine
Henry, W. A., III. (1990, April9).Makingthe gradeintoday's schools.*Time, 135*,28-31.

Article ina Newspaper
Unlike otherperiodicals, p.orpp. precedes page numbersfora newspaperreference in APAstyle.
Single pagestake p., e.g..,p. B2;multiplepagestake pp., e.g.., pp. B2, B4 orpp.C1, C3-C4.

Schultz, S. (2005, December28).Calls made tostrengthen state energypolicies.*The CountryToday*, pp. 1A, 2A.

Basic FormatforBooks
Author, A. A.(Yearofpublication).*Title ofwork:Capitalletteralsoforsubtitle*.Location:Publisher.
Note:For"Location,"you should always listthe city, butyou should alsoincludethe stateifthecityis unfamiliarorifthe citycould beconfused with oneinanotherstate.

Calfee, R. C., &Valencia,R. R. (1991).*APA guidetopreparing manuscriptsforjournalpublication*. Washington, DC:American PsychologicalAssociation.

GovernmentDocument
NationalInstitute ofMental Health.(1990).*Clinicaltraining inserious mentalillness* (DHHS Publication No. ADM 90-1679). Washington, DC:U.S. GovernmentPrintingOffice.

ReportFroma Private Organization
American Psychiatric Association. (2000).*Practiceguidelinesforthetreatmentofpatients with eating disorders*(2nd ed.). Washington, D.C.:Author.

ConferenceProceedings
Schnase,J.L., &Cunnius, E.L. (Eds.). (1995). Proceedings fromCSCL'95:*The FirstInternational Conferenceon ComputerSupport for CollaborativeLearning*. Mahwah, NJ:Erlbaum.

Article From an Online Periodical

Author, A. A., & Author, B. B. (Date ofpublication).Title ofarticle.*Title of Online Periodical, volume number*(issuenumberifavailable). Retrieved month day, year, (ifnecessary)from http://www.someaddress.com/full/url/

Bernstein, M.(2002).10tips on writingthelivingWeb.*AListApart:For People Who MakeWebsites, 149*. Retrieved May2, 2006, from http://www.alistapart.com/articles/writeliving

OnlineNewspaperArticle

Author, A. A.(Year, Month Day).Title ofarticle.*TitleofNewspaper*. Retrieved http://www.someaddress.com/full/url/

Parker-Pope, T.(2008,May6). Psychiatryhandbooklinked to drugindustry.*The New YorkTimes*. Retrieved fromhttp://www.nytimes.com

Electronic Books

De Huff, E.W.*Taytay'stales:TraditionalPueblo Indian tales*. Retrievedfrom http://digital.library.upenn.edu/women/dehuff/taytay/taytay.html

Davis,J.*Familiar birdsongs ofthe Northwest*. Available fromhttp://www.powells.com/cgi-bin/biblio?inkey=1-9780931686108-0

OnlineEncyclopedias andDictionaries

Feminism.(n.d.)In*Encyclopædia Britannica online*. Retrieved March 16, 2008, fromhttp:// www.britannica.com

Annexure B

Guidelines for Research/ Technical Seminar:

OBJECTIVE

The objective of the Research /Technical Seminar is to help the student develop ability to apply multi-disciplinary concepts ,tools and techniques to analyze and logically approach the organizational problems.

The Research topic may be from any one of the following types, however ,it should preferably be from your area of specialization in MCA:

    i)   Survey of Literature/Comprehensive case study(covering single organization/multifunctional area problem formulation, analysis and recommendations).

    ii)   Inter-organizational study aimedat inter-organizational comparison/validation of theory/ survey of management practices.

    iii)   Field study / Conclusion (empirical study).

REPORTPROPOSAL

Proposal should be prepared in consultation with the supervisor and submitted before the routine first MST in department. The length of there port may be about 25 to 30 double spaced typed pages not exceeding approximately

5000words (excluding appendices and exhibits). However, rational variation on either side is permissible.

The Proposal may have the following components:

a) Introduction, brief background, and Rationale of the topic chosen for the Research.
b) Brief Introduction and vital details of the organization/s understudy.
c) Statement of the Research problem.
d) Objectives of the Research (clearly stated in behavioural terms).
e) Research Methodology:

        ⎇   Research Design

        ⎇   Survey of Literature

        ⎇   Nature and source of data / information to be collected. Sample and sampling

        ⎇   technique. Rationale of chosen organization and the sample. Tools and

        ⎇   Techniques to be used for data collection – details of the tools/questionnaire to be used and its relevance with the objectives of the project.

        ⎇   Method/s to be used for data collection

        ⎇   Data handling and analysis

        ⎇   Statistical tools to be used for analysis

        ⎇   Conclusion.

f) Limitation of the proposed research work, if any.
g) Any other relevant detail which will help better appreciation and understanding of the research study.

EVALUATIONCRITERIAFORResearch/Technical Seminar

S.N.	Name	RollNo. &Date of Presentation	Introduction &Reviewof Literature	Rationale, Problem Definition, Scope&Objectives	Research Methodology	Data Analysis & Findings	Suggestions &Conclusion &Scopefor Future research	Overall Report Layout and Viva Performance	TotalEarned Marks (out of100)	Signature ofthe Evaluator with Date
			15	15	15	20	15	20	100	
1										
2										
3										

Name of Student: ………………………………………………………Roll No: ……………………………………………

Research/ Technical Seminar (Title)…………………………………………………………………………………………

Estimated duration…….

Name of Organization & Address…………………………………………………………………………………………

……..

……..

Nature of Research………..

(Application/Network/Web based) Research Description (Additional Pages is to be attached to give description of the work under the following heads)……….

……..

Features of the Research…………………………………………………………………………………………………….

Existing Papers……

Proposed Papers……….

Tools………

Requirements: Hardware & Software Requirements…………………………………………………………………

Signature of student   (Signature of Guide In- charge)