Apeejay Institute of Management and Engineering
Technical Campus, Jalandhar

Affiliated to I.K.Gujral Punjab Technical University(IKG-PTU), Kapurthala

Study Scheme & Syllabus of

Master of Computer Applications

School of Information Technology

Scheme & Syllabus of

Master of Computer Applications

(MCA)

Batch 2020 onwards

By

Board of Study Computer Applications

Department of Academics

IK GujralPunjab Technical 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 ofthe individual and society at large.

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA-B1	Bridge Course*	Computer Programming using C	2	0	0	50	-	50	S/US
PGCA-B2	Bridge Course*	Computer Science Essentials	2	0	0	50	-	50	S/US
PGCA1917	Core Theory	Discrete Structures & Optimization	4	0	0	30	70	100	4
PGCA1951	Core Theory	Programming in Python	4	0	0	30	70	100	4
PGCA1952	Core Theory	Advanced Data Structures	4	0	0	30	70	100	4
PGCA1953	Core Theory	Advanced Database Management System	4	0	0	30	70	100	4
PGCA1905	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	0	0	30	70	100	3
PGCA1954	Core Practical/Laboratory	Data Structures using Python Laboratory	0	0	4	70	30	100	2
PGCA1955	Core Practical/Laboratory	Advanced Database Management System Laboratory	0	0	4	70	30	100	2
PGCA1908	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	0	0	2	30	20	50	1
	TOTAL		**19**	**0**	**10**	**320**	**430**	**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.**

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1909	Core Theory	Web Technologies	4	0	0	30	70	100	4
PGCA1920	Core Theory	Design & Analysis of Algorithms	4	0	0	30	70	100	4
PGCA1918	Core Theory	Advanced Java	4	0	0	30	70	100	4
PGCA1956	Core Theory	Linux Administration	4	0	0	30	70	100	4
PGCA1932	Core Theory	Information Security & Cyber Law	4	0	0	30	70	100	4
PGCA1914	Core Practical/Laboratory	Web Technologies Laboratory	0	0	4	70	30	100	2
PGCA1922	Core Practical/Laboratory	Advanced Java Laboratory	0	0	4	70	30	100	2
PGCA1957	Core Practical/Laboratory	Linux Administration Laboratory	0	0	4	70	30	100	2
	TOTAL		**20**	**0**	**12**	**360**	**440**	**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		
PGCA1925	Core Theory	Advanced Computer Networking	4	0	0	30	70	100	4
PGCA1926	Core Theory	Artificial Intelligence & Soft Computing	4	0	0	30	70	100	4
PGCA1927	Core Theory	Theory of Computation	4	0	0	30	70	100	4
	Elective – I		4	0	0	30	70	100	4
	Elective – II		4	0	0	30	70	100	4
PGCA1928	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	0	0	4	70	30	100	2
PGCA1929	Core Practical/ Laboratory	Artificial Intelligence & Soft Computing Laboratory	0	0	4	70	30	100	2
	Elective – II Laboratory		0	0	4	70	30	100	2
PGCA1969		**Summer/Institutional Training	0	0	4	70	30	100	2
	TOTAL		**20**	**0**	**16**	**430**	**470**	**900**	**28**

Elective – I	
Course Code	**Course Title**
PGCA1930	Software Project Management
PGCA1971	Optimization Techniques
PGCA1972	Data Mining and Business Intelligence
PGCA1973	Enterprise Resource Planning

Elective – II	
Course Code	**Course Title**
PGCA1933	Mobile Applications Development
PGCA1935	Simulation & Modelling
PGCA1921	e-Commerce and Digital Marketing
PGCA1931	Software Testing & Quality Assurance

Elective – II Laboratory	
Course Code	**Course Title**
PGCA1934	Mobile Applications Development Laboratory
PGCA1936	Simulation & Modelling Laboratory
PGCA1974	e-Commerce and Digital Marketing Laboratory
PGCA1975	Software Testing & Quality Assurance Laboratory

Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1976	Core Theory	Machine Learning & Data Analytics using Python	4	0	0	30	70	100	4
PGCA1958	Core Theory	Advanced Web Technologies	4	0	0	30	70	100	4
PGCA1977	Core Practical/ Laboratory	Machine Learning & Data Analytics using Python Laboratory	0	0	4	70	30	100	2
PGCA1960	Core Practical/ Laboratory	Advanced Web Technologies Laboratory	0	0	4	70	30	100	2
	Elective – III		4	0	0	30	70	100	4
	Elective – III Laboratory		0	0	4	70	30	100	2
PGCA1961		Research/Technical Seminar	0	0	2	0	100	100	1
PGCA1962		Project	0	0	8	180	120	300	4
	TOTAL		**12**	**0**	**22**	**480**	**520**	**1000**	**23**

Elective – III	
Course Code	**Course Title**
PGCA1937	Cloud Computing
PGCA1963	Digital Image Processing
PGCA1965	NLP and Speech Recognition
PGCA1967	IOT &Blockchain Technology

Elective – III Laboratory	
Course Code	**Course Title**
PGCA1938	Cloud Computing Laboratory
PGCA1964	Digital Image Processing Laboratory
PGCA1966	NLP and Speech Recognition Laboratory
PGCA1968	IOT &Blockchain Technology Laboratory

Course Code: PGCA-B1
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	Student should be able to understand the logic building used in Programming.
CO2	Students should be able to write algorithms for solving various real life problems.
CO3	To convert algorithms into programs using C.

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. **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.	6
Unit-II **Data Input and Output:** formatted & unformatted input output. **Control Statements:** While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements.	8
Unit-III **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays.	8

Strings: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables. **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. **Objects and Classes:** Introduction to Object Oriented Concepts, Features of OOP, Basic of classes and Objects.	

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.

Course Code: PGCA-B2
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	Understanding the concept of input and output devices of Computers
CO2	Learn the basic concepts of Operating Systems and Database Systems
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. **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) **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. **Data Representation:** Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.	7
Unit-II **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors. **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. **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	**7**
Unit-III **DBMS:** Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. **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.	**8**

Data communications concepts: Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. **Types of Networks:** LAN, MAN, WAN, Topologies.	

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: PGCA1917
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion
CO2	Apply rules of inference, proof by contradiction, proof by cases, and write proofs using symbolic logic and Boolean Algebra
CO3	Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle.

CO4	Determine if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic, and determine the connectivity of a graph.

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. **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) **Combinatorial Mathematics:** Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Application	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. **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.	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.

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: PGCA1951
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: 30	**Duration of end semester exam (ESE):**3hrs
External max. marks:70	**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	Familiar with Python environment, data types, operators used in Python.
CO2	Compare and contrast Python with other programming languages.
CO3	Learn the use of control structures and numerous native data types with their methods.
CO4	Design user defined functions, modules, and packages and exception handling methods.
CO5	Create and handle files in Python and learn 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. **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. **Operators and Expressions:** Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators. **Control Structures:** Decision making statements, Python loops, Python control statements. **Python Native Data Types:** Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).	22 hours
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. **Python Modules:** Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages. **Exception Handling:** Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. **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. **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.	22 hours

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: PGCA1952
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Choose appropriate data structures and algorithms and use it to design solution for a specific problem.
CO2	Execute the operations of hashing to retrieve data from data structure.
CO3	Design and analyze programming problem statements
CO4	Come up with analysis of efficiency and proofs of correctness
CO5	Comprehend and select algorithm design approaches in a problem specific manner.

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.	22 Hours

Sorting Algorithms: Quick Sort, Heap Sort, Counting Sort, Bucket Sort, Multi-way Merge Sort. Hashing Techniques: Direct Address Tables, Hash Tables, Hash Functions, Open Addressing, Perfect Hashing. Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Binomial Heaps, Fibonacci heaps, Data Structures for Disjoint Sets.	
Part B Graphs & Algorithms: Graphs Representation, Minimum Spanning Tree (MST), Single Source Shortest Paths, All Pairs Shortest Paths, Maximum Flow. 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.	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: PGCA 1953
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Apply the concept of Transaction Management & Recovery techniques in RDBMS.
CO4	Analyze various advanced databases prevailing in market, Big Data, Temporal Databases, Parallel and Distributed Databases, XML Database and multidimensional Databases
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, **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). **Normalization** and its various forms, Functional Dependencies, Multi-valued Dependencies, Join Dependencies Database Integrity: Domain, Entity, Referential Integrity Constraints **Relational Languages**: Relational Algebra, Relational Calculus, Query Execution, optimization and evaluation Plans. **Transaction Management and Concurrency Control** techniques, Database Recovery Management Concepts and methods. Introduction and Need of **Database Administration** and activities of Database administration.	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 **Distributed Database Concepts** : Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing **Multidimensional Databases** and their uses in data analytics. **Temporal Databases :** Introduction to Temporality, Temporal relationships, temporal hierarchies.	22 Hours

Spatial Databases: Spatial data types, spatial relationships, Topological Relationships, Spatial Data Structures and methods of storage. **Big Data :** introduction: introduction to **NOSQL Databases** (Open Source only). Need and usage of **XML Databases:** XML Data Model – DTD – XML Schema	

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: PGCA1905
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: 30	**Theory/Practical:** Theory
External max. marks: 70	**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-

Course Outcomes:

CO#	Course outcomes
CO1	The objective of the course is to help the students become the independent users of English language.
CO2	Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills.
CO3	Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.

CO4	They will be able to converse fluently.
CO5	They will be able to produce on 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. **Basic Technical Writing:** Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters– Format &various types.	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. **Verbal Communication:**Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences. **Technical Communication:**MS-Word, Adobe Frame maker and ROBO Help * 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: PGCA1954
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: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**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:

CO#	Course outcomes
CO1	Understand the concept of data structures, python and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.
CO2	Implement linear and non-linear data structures for processing of ordered or unordered data.
CO3	Analyze various algorithms based on their time and space complexity.

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 through the list.
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: PGCA1955
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: 70	**Duration of end semester exam (ESE):** -
External max. marks: 30	**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 query a database using SQL DML/DDL commands.

CO2	Analyze integrity constraints on a database
CO3	Develop PL/SQL programs including stored procedures, stored functions, cursors
CO4	Design new database and modify existing ones for new applications and reason about the efficiency of the result.
CO5	Implement various DBA roles/techniques

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: PGCA1908

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	The objective of the course is to help the students become the independent users of English language.
CO2	Students will acquire basic proficiency in listening and speaking skills.
CO3	Students will be able to understand spoken English language, particularly the language of their chosen technical field.
CO4	They will be able to converse fluently
CO5	They will be able to produce on their own clear and coherent texts.

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: PGCA1909
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Understand the basics of Internet and Web Services.
CO2	Describe and differentiate Programming Language and Markup Language.
CO3	Connect various web pages and web sites together.
CO4	Capture user input from the remote users.
CO5	Learn connectivity concepts of Front End and Back End.

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, 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). **Basic Formatting Tags:** HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles,	24 hours

Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. **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. Lists **Type of Lists** (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. **Adding Graphics To HTML Documents:** Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute. **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.	
Part-B **Linking Documents:** Links (External Document References, Internal Document References), Image As Hyperlinks. **Frames:** Introduction to Frames: The<FRAMESET> tag, The <FRAME> tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style **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. **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).	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: PGCA1920
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:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**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	Categorize problems based on their characteristics and practical importance
CO2	Develop Algorithms using iterative/recursive approach
CO3	Design algorithm using an appropriate design paradigm for solving a given problem
CO4	Classify problems as P, NP or NP Complete

Detailed contents	Contact hours
Part A	24 Hours

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. **Basic Algorithm Design Techniques:** Divide-and-conquer, Greedy approach, Randomizationand dynamic programming. **Example problems on Backtracking:** n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and- Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.	
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. **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.	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: PGCA1918
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Learn the advanced features of Java and write the programs.
CO2	Work with API and implement Serialization concept of Java.
CO3	Learn Java Generics and develop Projects.

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. **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. **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 . **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. **Remote Method Invocation:** Defining the remote interface, Implementing the remote interface, Compiling and executing the server and the client. **Common Object Request Broker Architecture (CORBA):** Overview of	22 Hours

technical architecture, CORBA basics, CORBA services.	

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: PGCA1956
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Understand the technical details of Linux operating system
CO2	Work with various Linux command and understand file hierarchical structuring
CO3	Administrate user, manage and configure packages in Linux
CO4	Know and configure the various internet services.

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	22 Hours

commands, working with vi Editor, **Understanding files and File System:**Understanding Files and Directories in Linux, File Structure and hierarchy, File Permissions, File Management and Manipulation, Managing File System **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	
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	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

Course Code: PGCA1932
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Acquire knowledge about various Information Systems.
CO2	Understand 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 Introduction to Information System, classification and components of information system, Computer Security Concepts, CIA (Confidentiality, integrity and availability),Security Functional Requirements. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. **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	22 Hours

Attacks.	
Part B **Intrusion Detection:** Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots. **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) **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.	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: PGCA1914
Course Name: Web Technologies 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: 70	**Duration of End Semester Exam (ESE):** 3hrs
External max. marks: 30	**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	Understand Static and Dynamic concepts of web designing.
CO2	Develop ability to retrieve data from a database and present it online.
CO3	Design web pages that apply various dynamic effects on the web site.
CO4	Solve complex and large problems using Scripting Language & Markup Language.

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

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 scientific 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: PGCA1922
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: 70	**Duration of end semester exam (ESE):** -
External max. marks: 30	**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	Learn the advanced features of Java and write the programs.
CO2	Work with API and implement Serialization concept of Java.
CO3	Learn Java Generics and develop Projects.
CO4	Understand to use digital marketing for developing effective digital and social media strategies

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: PGCA1957

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:70	**Duration of end semester exam (ESE): -**
External max. marks:30	**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	Install Linux desktop and Linux server operating system.
CO2	Use various commands for performing different operations
CO3	Work with various Linux administration commands
CO4	Install and configure various servers in Linux environment

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: PGCA1925
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Familiar with the different Network Models.
CO2	Understand different protocols working at Medium Access Sub layer.
CO3	Learn the concept of network routing through algorithms.
CO4	Learn and understand Internet protocols and network security.

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 **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) **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. **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 **Medium Access Sub-Layer**: Static and dynamic channel allocation, Random Access: ALOHA, CSMA-CA/CD protocols, Controlled Access: Polling, Token Passing **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. **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.	22 Hours
Part B 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. **Wireless Communication Systems**: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA.	22 Hours

Wireless System Design: Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.	

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: PGCA1926
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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 the significance and domains of Artificial Intelligence and knowledge representation.
CO2	Examine the useful search techniques; learn their advantages, disadvantages and comparison.
CO3	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.

CO4	Apply artificial neural networks and fuzzy logic theory for various problems.
CO5	Determine the use of Genetic algorithm to obtain optimized solutions to 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. **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. **Informed (Heuristic) Search Strategies**-Hill Climbing, Simulated Annealing, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search. **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 Backpropagation(BP)Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications. Unsupervised Learning Networks. **Fuzzy Systems:** Fuzzy Set theory, Fuzzy vs. Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification. **Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization. Introduction to Hybrid Systems.	22 Hours

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: PGCA1927
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: 30	**Duration of end semester exam (ESE):**
External max. marks:70	**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	Use basic concepts of formal languages of finite automata techniques.
CO2	Design Finite Automata's for different Regular Expressions and Languages.
CO3	Construct context free grammar for various languages.
CO4	**S**olve various problems of applying normal form techniques, push down automata and Turing Machines.
CO5	**S**olve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

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. **Regular Sets and Regular Grammars:** Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis. **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.	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). **Turing Machines (TM):** Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis. **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.	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: PGCA1928
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: 70	**Duration of end semester exam (ESE):**
External max. marks: 30	**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	Familiarize themselves with the different Network Models.
CO2	Understand working of different devices used to set up LAN.
CO3	Learn the concept of network routing.
CO4	Learn and understand Internet protocols and network security.

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: PGCA1929
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:70	**Duration of end semester exam (ESE):** 3hrs
External max. marks:30	**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 the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO2	Apply artificial neural networks and fuzzy logic theory for various problems.
CO3	Determine the use of Genetic algorithm to obtain optimized solutions to problems.

Instructions: Develop the assignments in MATLAB/Python.

Assignments:

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

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Course Code: PGCA1930
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: 30	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 70	**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	Understand and practice the process of project management
CO2	Develop the scope of work, provide accurate cost estimates and to plan the various activities.

CO3	Understand and use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales
CO4	Identify the resources and people required for a project and to produce a work plan and resource schedule.

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. **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 **Project Evaluation and Planning** - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit 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.	22 Hours
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. **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. **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	22 Hours

structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. Overview of project management tools for software.	

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: PGCA1971
Course Name: Optimization Techniques

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:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**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	Formulate and solve linear programming problems
CO2	Frame and resolve the transportation and assignment problems
CO3	Understand the Project Management problems using CPM
CO4	Find solution to two person zero-sum games

Detailed contents	Contact hours
Part A **Scope of Operations Research:** Introduction to linear and non-linear programming formulation of different models. **Linear Programming:** Geometry of linear programming, Graphical	24 Hours

method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis. **Integer Programming:** Branch and bound technique.	
Part B **Transportation and Assignment Problem:** Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions. **Project Management:** Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing. **Game Theory:** Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.	20 Hours

Text Books:

1.Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).

2.Taha H.A., Operations Research-An Introduction, PHI (2007).

Reference Books:

1.Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)

2.Bazaarra Mokhtar S., Jarvis John J. and Shirali Hanif D., Linear Programming and Network flows, John Wiley and Sons (1990)

3.Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).

Course Code: PGCA1972
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:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Understand basic concepts of data warehouse and business intelligence
CO2	Perform various data warehouse-related problems
CO3	Analyze data and relate to real-world scenario
CO4	Deriving intrinsic facts from data

Detailed contents	Contact hours
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 **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 **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	24 Hours
Part B **Concept Description and Association Rule Mining:** Introduction, Data Generalization and summarization-based characterization, Association Rule	20 Hours

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., **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 .	

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. Paulraj Ponnian, "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: PGCA1973
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Analyse a business processes of different functional areas
CO2	Understand ERP & Related Technologies
CO3	ERP Implementation Strategies
CO4	Use and apply this knowledge in E Commerce & E Governance related applications.

Detailed contents	Contact hours
Part A **Basic ERP Concepts:** Enterprise-An overview, Benefits & Risk, Evolution and Structure, Conceptual Model of ERP. **ERP & Related Technologies:** Business Process Reengineering (BPR), Data Warehousing and Data Mining, OLAP, Product Life Cycle Management, Supply Chain management, CRM. **ERP Functional Module:** Introduction, Finance, Manufacturing, Human Resource, Plant maintenance, Material Management, Integration of ERP, Supply Chain and Customer Relationship Application.	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. **Strategic Grid:** Useful guidelines for ERP Implementations. **Post Implementation :** Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Calculation of	22 Hours

ROI 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. **Case Studies:** Development and Analysis of ERP Implementations	

Text Books:

1. Alexis Leon, "Enterprise Resource Planning", TMH, 2nd Ed.
2. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning Concepts and Practice". PHI
3. V.K. Garg & N.K. Venkita Krishnan. "ERP Ware: ERP Implementation Framework", PHI.

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: PGCA1933
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Know the components and structure of mobile application development frameworks for Android and iOS based mobiles.
CO2	Understand how to work with various mobile application development frameworks.

CO3	Design and implement the user interfaces of mobile applications.
CO4	Develop useful mobile applications using Google Android and Eclipse simulator.

Detailed contents	Contact hours
Part A **Introduction**: Mobile Applications –Characteristics and Benefits – Frameworks and Tools, Types, Application Model. Profiles of Mobile devices. **Building Blocks of Mobile Applications:** User Interface Designing, Layout, User Interface elements, Functionality based user interface, Naïve Data Handling, Sprucing up Mobile applications **Testing Mobile Applications:**Debugging Applications, Testing Strategies, Test Automation of Applications.	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. **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. **IOS:**Development environment, iOS Layers, Architecture, User Interface tool kit interfaces, Event handling, Graphics services, Layer Animation,BasiciPhone Styling, Advanced iPhone Styling.	22 Hours

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: PGCA1934
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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**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	Understand how to work with various mobile application development frameworks.
CO2	Develop mobile applications using GUI and Layouts
CO3	Learn the basic and important design concepts and issues of development of mobile applications.
CO4	Analyze and discover own mobile app for simple needs.

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 as above. 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: PGCA1935
Course Name: Simulation & Modelling

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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Identify the paradigms and approaches used to design the simulation.
CO2	Understand the various types of simulation, techniques and methods.

CO3	Apply concepts of computer simulation for types of inputs, system models, output behavior and performance estimation
CO4	Test the goodness of a simulation by analyzing the simulated data.

Detailed contents	Contact hours
Part A **Inventory Concept:** The technique of Simulation, Major application areas, concept of a System, Environment, Continuous and discrete systems, systems modeling types of models progress of a Simulation Study, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Numerical Computation Technique for discrete and continuous models, Continuous System Simulation. **Input Modeling-** Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile-Quantile Plots.100 Parameter Estimation: Sample Mean and Sample Variance and various biased and unbiased Estimators. Goodness of Fit Tests applied to Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, pValues and Best Fits. **Verification and Validation of Simulation Models-** Verification and Validation of Simulation Models. Calibration and Validation: Face Validity, Validation of Assumptions, Input-Out Transformation Validation. **Output Analysis of a Single Model-** Output analysis and types of simulation. Stochastic Nature of the Output Data. Measures of Performance and Estimation: Point Estimation and Confidence-Interval Estimation. Output Analysis for Terminating Simulations and Estimation of Probabilities. Output Analysis of Steady State Simulations: Initialization Bias, Error Estimation, Replications, Sample Size and Batch Means for Interval Estimation.	26 Hours
Part B **Simulation of Queuing Systems:** Rudiments of queuing theory, Simulation of single-server queue, Simulation of two-server queue. **Simulation Software-** Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products**.** **Simulation Languages:** Basic Introduction to Special Simulation Languages:-GPSS/ MATLAB/ Network Simulators.	18 Hours

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, Discrete-Event System and Simulation, Prentice Hall of India, New Delhi, 2005
2. Gordon, G: System Simulation, Prentice-Hall; 2 edition (1979).

Reference Books:

1. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009
2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems, Academic Press, 2000.
3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons. Bhat, U. Narayan, An Introduction to Queueing Theory: Modeling and Analysis in Applications, Springer 2008 (Birkhäuser Boston).
4. James J. Nutaro, Building software for simulation: theory and algorithms, with applications in C++. Wiley, 2010.

Course Code: PGCA1936
Course Name: Simulation & Modelling 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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**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	Understand the use of software tools for modelling and analysis of mathematical concepts for engineering application.
CO2	Know how to simulate any discrete system using queuing systems.
CO3	Model and analyze simple engineering concepts and its importance in engineering applications.
CO4	Develop skills to apply simulation software to construct and execute goal-driven system models.

Sr. No.	Assignments

1	Installation of MATLAB.
2	Write a program in MATLAB using different types of branching statements.
3	Write a program to perform basic matrix operations.
4	WAP to plot different types of graphs in MATLAB.
5	Write a MATLAB code to plot with the elements of its vector representation
6	Programs on simulation of real time systems for automation purpose.
7	Simulation of continuous and discrete systems.
8	Programs on testing the random number set for uniformity and independence – Kolmogorov-Smirnov test, Chisquare test, Runs test and Autocorrelation test.
9	Programs on simulation of single and two-server queuing systems..
10	Programs on simulation of an inventory system.

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, Discrete-Event System and Simulation, Prentice Hall of India, New Delhi, 2005
2. Gordon, G: System Simulation, Prentice-Hall; 2 edition (1979).

Reference Books:

1. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009
2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems, Academic Press, 2000.

Course Code: PGCA1921
Course Name: E-Commerce & Digital Marketing

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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Understand various applications and scope of ecommerce.
CO2	Acquire knowledge of various payment modes used in ecommerce today.

CO3	Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan
CO4	Describe how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy, Developing effective digital and social media strategies
CO5	Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media

Detailed contents	**Contact hours**
Part A Introduction to Electronic Commerce: Technical Components of E-commerce, E-Commerce Framework, E-Commerce Applications and Electronic Business. Internet Service provider and World wide web. Architectural Framework for Electronic Commerce, WWW as the Architecture and Hypertext publishing. Electronic payment System : Types and Traditional payment, Value exchange system, Electronic funds transfer, Digital Token Based Electronic Payment System, Smart Cards – Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems. Electronic Data Interchange : Concepts and applications of EDI and Limitation. EDI and Electronic Commerce standardization and EDI – EDI Software Implementation. EDI Applications in Business – EDI: Legal, Security and Privacy issues.E- Governance for India : Indian customer EDI system and Service centres.	22 Hours
Part B Introduction to Digital Marketing : Components of Online Marketing (Email, Forum, Social network, Banner, Blog) , Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing, Online Advertising, Mobile Marketing, Web analytics and Email Marketing. Search Engine Optimization (SEO) and Social Engine Marketing (SEM).: Importance of Internet and Search Engine and Role of Keywords in SEO, On-Page Optimization (Onsite) and Off Page Optimization. Introduction to Social Media Marketing (SMM). Website Planning & Creation : Content Marketing Strategy, Keywords Research and Analysis, Web Presence and Creating content. Successful content marketing strategies and case studies.	22 Hours

Text Books:

4. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
5. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
6. Damian Ryan, Calvin Jone. Kogan Page; "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation".

Reference Books:

1. Seema Gupta, Digital Marketing, McGraw Hill
2. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
3. 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.
4. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
5. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.

Course Code: PGCA 1955

Course Name: e-Commerce and Digital Marketing Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 3rd	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical**: Practical
External max. marks: 30	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Elective-II

Prerequisite: --

Co requisite: --

Additional material required in ESE:--

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

CO#	Course Outcomes
CO1	Understand of implementation of ecommerce applications.
CO2	Learn to develop and implement digital marketing strategy and plan
CO3	Implement and developing effective digital and social media strategies
CO4	Implementation and working on the social, and security issues concerning the digital marketing and e-commerce.

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

Assignments:

Develop Strategy/ Case Study for a Company/ Website enhancing its Online visibility using following tools/channels:

1.	Social media marketing and optimization
2.	YouTube Marketing

3.	Facebook marketing
4.	Email marketing
5.	LinkedIn
6.	Twitter
7.	Google Analytics
8.	Mobile Advertising
9.	Content Marketing: Optimize customer and user experience
10.	Creating & publishing Blogs

Text Books:

7. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
8. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
9. Seema Gupta, "Digital Marketing", McGraw Hill
10. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson.
11. 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.

Course Code: PGCA1931
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: 30	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 70	**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.

Detailed contents	Contact hours
Part A **Software Testing:** Testing, Verification and Validation, Test Strategies for Conventional andObject Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha andBeta Testing, System Testing,	26 Hours

Recovery Testing, Security Testing, Stress Testing,Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies. **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 BasedTesting Methods, Equivalence Partitioning, **Object Oriented Testing Methods:** Applicabilityof Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-BasedTesting, Scenario-Based Testing, Random Testing and Partition Testing for Classes,InterClass Test Case Design. **Testing Process and Specialized Systems Testing:** Test Plan Development, RequirementPhase, Design Phase and Program Phase Testing, Testing Client/Server Systems, TestingWeb based Systems, Testing Offthe-Shelf Software, Testing in Multiplatform Environment,Testing for Real Time Systems, Testing Security.	
Part B **Software Quality Assurance Concepts and Standards:** Quality Concepts, Quality Control,Software Quality Attributes, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, ReviewGuidelines, 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. **Risk Management and Change Management:** Software Risks, Risk Identification, RiskProjection, 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.	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: PGCA1956
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: 70	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 30	**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.

Assignments:

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,Loadrunner or any other similar tools

Text Books:

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

Reference Books:

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

Course Code: PGCA1976
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Learn Machine Learning concepts
CO2	Understand the difference between supervised and unsupervised learning
CO3	Learn clustering and classification algorithms
CO4	Analyse data using Python Numpy, Panda Libraries
CO5	Visualize data using matplotlib library of Python

Detailed contents	Contact hours
Part A	22 Hours

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

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: PGCA 1958
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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 client-side and server-side programming.
CO2	Learn to represent web data and XML document handling.
CO3	Understand AJAX and relevance.
CO4	Develop a dynamic webpage by the use of java PHP and MySQL.
CO5	Able to learn how to perform basic CRUD database operations in a Dynamic Website.
CO6	Learn about web services and their development.

Detailed contents	Contact hours
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. **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 **Introduction to Web Services:** Use of Web Services, Types of Web Services, Introduction to Content Management System CMS (Types, Usages, Benefits).	22 Hours
Part B **XML**: Introduction to XML, XML Basics, XML Syntax and Editors, documents, Elements, Attributes. Creating XML documents. **Ajax** : Introduction and Use of Ajax in Website. **jQuery** : Introduction, jQuery UI: Date picker, auto complete, tooltip, accordion, retrieving page content, manipulating page content, working with events. **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:

4. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
5. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
6. W. Jason Gilmore,"Beginning PHP and MySQL: From Novice to Professional", Apress.
7. "Learning PHP, MySQL, JavaScript, CSS and HTML 5", Robin Nixon, O'Reilly publication
8. Web Technologies, Black Book, dreamtech Press
9. 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: PGCA1977
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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**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 various learning models of data.
CO2	Implement a wide variety of learning algorithms.
CO3	Understand how to evaluate 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.	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: PGCA 1960
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: 70	**Theory/Practical**: Practical
External max. marks: 30	**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#	Course Outcomes
CO1	Understand the advance concepts of website development.
CO2	Provide skills to design and develop dynamic web sites.
CO3	Work independently for database programming for web applications
CO4	Understand concepts of jQuery methods, AJAX, Bootstrap and REACT
CO5	Connect Website with an Database Server and 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	
26.	PHP Code to display today's date in dd-mm-yyyy format.
27.	PHP Code to check if number is prime or not.
28.	PHP Code to print first 10 Fibonacci Numbers.
29.	PHP Code to read data from txt file and display it in html table (the file contains info in format Name: Password: Email)
30.	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.
31.	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)
32.	PHP Script for user authentication using PHP-MYSQL. Use session for storing username.
Implement the following with specific web applications	
33.	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.
34.	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.
35.	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.
36.	Modify the specific web applications to use AJAX to show the result on the same page.
37.	Enhance functionality of the specific web applications using BOOTSTRAP
38.	Create a responsive Photo Gallery in BOOTSTRAP
39.	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
40.	Modify your answer for above question with PHP and MYSQL database and Perform CRUD operations with AJAX

41.	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.
42.	Build a Registration Form and Validate it with JQuery. Registration Form must have at least 10 elements.
43.	Design a Sign In, Sign Up and Forgot Password Page with BOOTSTRAP. Use PHP and MYSQL to store Sign Up data in Database.
44.	Create a Star Rating System in JQuery.
45.	Create a simple To-do list Application with REACT
46.	Create a Calculator with REACT
47.	Create a Photo Gallery with REACT. Also implement search operation
48.	How can you create a Portfolio App with Node.js?
49.	Create a simple Shopping Cart with REACT and Node.js
50.	Modify your Shipping Cart with JQuery, JSON and AJAX functionality.

Reference Books:

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

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Course Code: PGCA1937
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: 30	**Duration of end semester exam (ESE):**
External max. marks:70	**Elective status: core/elective** Elective-III
Total marks:100	

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

CO#	Course outcomes
CO1	Understand the basic concept and importance of cloud computing.
CO2	Access the suitability of migrating to a cloud solution for different applications.
CO3	Compare and evaluate the virtualization technologies.

CO4	Monitor and manage the cloud resources, applications and data while addressing the security concerns.
CO5	Use cloud solutions offered by industry leaders for various applications.

Detailed contents	**Contact hours**
Part A **Overview of Computing Paradigm:** Recent trends in Computing - Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. **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. **Migrating into a Cloud:** Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud. **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. **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. **Cloud Storage:** Provisioning Cloud Storage, Virtual storage containers, Cloud Storage Interoperability (CDMI, OCCI), Database Storage, Resource Management, **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.	22 hours

Text Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, 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:PGCA 1938
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: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**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.

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: PGCA1963
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:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**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 for various image transforms along with properties
CO2	Learn different techniques employed for the enhancement of images
CO3	Understand the rapid advances in Machine vision
CO4	Analyze images in multiresolution environment
CO5	Learn image compression techniques

Detailed contents	Contact hours
Part A **Introduction:** Fundamental steps in Digital Image Processing, Components of an image processing system, Image sampling and quantization, Color models	24 Hours

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. **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. **Image Enhancement in Frequency Domain:** Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters.	
Part B **Image Restoration:** A model of the image degradation/restoration process, Noise models, Noise filters, Degradation function. **Multiresolution Analysis:** Wavelet analysis, Continuous wavelet transform, Discrete wavelet transform, Wavelet decomposition and reconstruction in two dimensions, Wavelet packet analysis, Wavelet based image denoising. **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. **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,	20 Hours

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: PGCA1964

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: 70	**Theory/Practical**: Practical
External max. marks: 30	**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	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 no.	Assignments
51.	Installation of image processing software and use of basic image processing commands.
52.	Generation of lines, array, matrix and image
53.	Reading and displaying images in different formats using different color models
54.	Converting color images into monochrome images
55.	Displaying of image Histogram
56.	Image color enhancements using pseudo coloring techniques
57.	Image restoration techniques.
58.	Application of image processing operations
59.	Point, Line, and Edge Detections in images
60.	Boundary Detections in images
61.	Color image processing
62.	Wavelet transforms.
63.	Image compression techniques
64.	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.

Course Code: PGCA1965
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: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Learn basics of natural language processing
CO2	Understand the text normalization, use of edit distance, and regular expressions
CO3	Learn Naive bayes and sentiment classification algorithms
CO4	Familiarize with chatbots and phonetics
CO5	Learn the concept of speech recognition and text to speech conversion.

Detailed contents	Contact hours
Part A **Introduction to Natural Language Processing** **Regular Expressions, Text Normalization, Edit Distance:** Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance **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 **Logistic Regression:** Classification: the sigmoid, Learning in Logistic Regression, The cross-entropy loss function, Gradient Descent,	22 Hours

Regularization, Multinomial logistic regression, Interpreting models, Advanced: Deriving the Gradient Equation	
Part B **Chatbots & Dialogue Systems:** Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design **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	22 Hours

Text Books:

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

Reference Books:

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

Course Code: PGCA1966
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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**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	Understand a wide variety of learning algorithms.
CO3	Understand how to evaluate 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:

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

Assignments:

10.	Write a Program for Word Analysis.
11.	Write a Program for Word Generation.
12.	Write a program to implement Morphology.
13.	Write a Program to implement N-Grams.
14.	Write a Program to implement N-Grams Smoothing.
15.	Write a Program to implement POS Tagging: Hidden Markov Model.
16.	Write a Program to implement POS Tagging: Viterbi Decoding
17.	Design and evaluate a data model using Linear Regression.
18.	Design and evaluate a data model using Logistic Regression.
19.	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:

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

Course Code: PGCA1967
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:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Enumerate the steps involved in IoT system design methodology
CO3	Gain Knowledge about the working of bit coin crypto currency
CO4	Describe 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. **Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates. **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. **Domain Specific IoTs**: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle	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 Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain **Bitcoin and Blockchain**: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin	20 Hours

Network, Block Mining, Block propagation and block relay. **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	

Text Books:

5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
6. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
7. 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: PGCA1968
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: 70	**Theory/Practical**: Practical
External max. marks: 30	**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 and Use IoT sensors and remotely monitor data and control devices.
CO2	Develop real life IoT based projects.
CO3	Understand blockchain technology and develop blockchain based solutions.
CO4	Build and deploy IoT based blockchain applications for on-premise and cloud based architecture.

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

Assignments:

65.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.

66.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
67.	Interfacing Rain Sensing Automatic Wiper System
68.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
69.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
70.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
71.	Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to and from thingspeak cloud.
72.	Interfacing smoke sensor to give alert message to fire department.
73.	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.
74.	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.
75.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
76.	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: PGCA1961
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.

Course Code: PGCA1962
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.

PROJECT PROPOSAL 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

PROJECT PRE-SUBMISSION:

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

The guidelines for project report are as follows:

- The length of the report may be about 60 to 80 double spaced typed pages not exceeding approximately 18,000 words (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 (Questionnaire used etc.)
- 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 incorporating changes, if any, pointed out during internal evaluation, the final Project Report in Hard Bound form (3 copies) 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.**

EVALUATION CRITERIA FOR PROJECT REPORT (MCA-PGCA1962)

S.No.	Name	Roll No. & Date of Presentation	Synopsis	Problem Definition / Need & Scope of the Study	Methodology & Objectives	Data Analysis & Findings	Testing and Implementation	Suggestions & Conclusion	Overall Report Writing & Layout	Total Earned Marks out of (170)	Signature of the 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 (MCA PGCA1962)" = 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. Above 75% = 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

"PROJECT TITLE"

Submitted to

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

KAPURTHALA

In partial fulfillment 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

Logo of the Institute

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 herewith.

STUDENT DECLARATION (On a Separate Page)

I, "_____ (Student Name)", hereby declare that I have undergone my Project at "_____(Institute/Industry Name)" from ___(start date) to ____(end date). I have completed a research project tilted "_____ (Project Title)" under the guidance of Mr. /.Ms. _____(Name of Supervisor).

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

_____

(Student name and Signature)

FACULTY DECLARATION (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 Project 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

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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 OF TABLES

TABLE NO.	TABLE TITLE	PAGE NO.

LIST OF FIGURES

FIGURE NO.	FIGURE TITLE	PAGE NO.

General Guidelines for Layout and format

1. Paper Size must be A4 and margins should be maintained on all pages as follows: **Left margin = 1.5" (wider for binding) Top, right & bottom margins = 1"**
2. Use **Times New Roman** font, **12 point**size, for text. and **14 point** size for headings
3. Use **1.5** ***line spacing***for all text in the main body of the thesis.
4. Report should contain page numbers (1, 2, 3….) starting from Introduction Chapter. 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 of commencement of 3rd Semester
2. Questionnaires in original to be retained by the students for the final presentation if required.

Guidelines on Faculty Guide-Student Interaction

1. The Student is required to be in constant touch with their Faculty Guide through email, telephone, personal interactions etc.
2. It is mandatory for the student to provide a weekly progress report to their Faculty Guides for each week of their Project.
3. The Topic for the Project should be chosen in consultation with their Faculty guide and after their due approval.
4. Same topics having any sort of duplicacy shall not be acceptable.
5. Institute will be conducting surprise visits of the organization where the Student is undergoing Project from time to time and any students found to be irregular / not attending their Project then the Project report of the said student shall stand cancelled .

Preparing References/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 in a Magazine

Henry, W. A., III. (1990, April 9). Making the grade in today's schools.*Time, 135*, 28-31.

Article in a Newspaper

Unlike other periodicals, p. or pp. precedes page numbers for a newspaper reference in APA style. Single pages take p., e.g.., p. B2; multiple pages take pp., e.g.., pp. B2, B4 or pp. C1, C3-C4.

Schultz, S. (2005, December 28). Calls made to strengthen state energy policies. *The Country Today*, pp. 1A, 2A.

Basic Format for Books

Author, A. A. (Year of publication).*Title of work: Capital letter also for subtitle*. Location: Publisher.
Note: For "Location," you should always list the city, but you should also include the state if the city is unfamiliar or if the city could be confused with one in another state.

Calfee, R. C., & Valencia, R. R. (1991).*APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.

Government Document

National Institute of Mental Health.(1990). *Clinical training in serious mental illness* (DHHS Publication No. ADM 90-1679). Washington, DC: U.S. Government Printing Office.

Report From a Private Organization

American Psychiatric Association. (2000). *Practice guidelines for the treatment of patients with eating disorders* (2nd ed.). Washington, D.C.: Author.

Conference Proceedings

Schnase, J.L., &Cunnius, E.L. (Eds.). (1995). Proceedings from CSCL '95: *The First International Conference on Computer Support for Collaborative Learning*. Mahwah, NJ: Erlbaum.

Article From an Online Periodical

Author, A. A., & Author, B. B. (Date of publication).Title of article.*Title of Online Periodical, volume number*(issue number if available). Retrieved month day, year, (if necessary) from http://www.someaddress.com/full/url/

Bernstein, M. (2002).10 tips on writing the living Web.*A List Apart: For People Who Make Websites, 149*. Retrieved May 2, 2006, from http://www.alistapart.com/articles/writeliving

Online Newspaper Article

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

Parker-Pope, T. (2008, May 6). Psychiatry handbook linked to drug industry. *The New York Times*. Retrieved from http://www.nytimes.com

Electronic Books

De Huff, E.W. *Taytay's tales: Traditional Pueblo Indian tales*. Retrieved from http://digital.library.upenn.edu/women/dehuff/taytay/taytay.html

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

Online Encyclopedias and Dictionaries

Feminism.(n.d.)In *Encyclopædia Britannica online*. Retrieved March 16, 2008, from http://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 aimed at inter-organizational comparison/validation of theory/survey of management practices.
iii) Field study / Conclusion (empirical study).

REPORT PROPOSAL

Proposal should be prepared in consultation with the supervisor and submitted before the routine first MST in department. The length of the report may be about 25 to 30 double spaced typed pages not exceeding approximately 5000 words (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 behavioral 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.

I.K.G. Punjab Technical University
MCA Batch 2020 onwards

EVALUATION CRITERIA FOR Research/Technical Seminar

S.N.	Name	Roll No. & Date of Presentation	Introduction & Review of Literature	Rationale, Problem Definition, Scope & Objectives	Research Methodology	Data Analysis & Findings	Suggestions & Conclusion &Scope for Future research	Overall Report Layout and Viva Performance	Total Earned Marks (out of 100)	Signature of the 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).....

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.....

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Features of the Research.....

Existing Papers.....

Proposed Papers.....

.

Tools.....

.....

Requirements: Hardware & Software Requirements.....

..

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..

Signature of student (Signature of Guide In-charge)