NETAJI SUBHAS UNIVERSITY

Estd. Under Jharkhand State Private University Act, 2018

Department of Information Technology (IT)

Master of Computer Applications (MCA)

Course Curriculum

(with CO, PO Structure)

w.e.f. 2020

Head
Department of IT
Netaji Subhas University

Dean Academics
Netaji Subhas University
Jamshedpur, Jharkhand

VISION:-

To achieve global excellence in education, research, and development in Information Technology by embracing rapid technological advancements.

MISSION:-

- To produce technologically competent and ethically responsible graduates through balanced and dynamic curriculum.
- To take up creative research in collaboration with Government, Industries and professional societies to make the nation as a knowledge-power.
- To produce successful graduates with personal and professional responsibilities and commitment to lifelong learning.

PEOs (Program Educational Objectives)

PEO1: Industry-Ready Professionals: Graduates will be prepared to pursue successful careers in Information Technology, equipped with the technical, analytical, and problem-solving skills necessary to work in diverse sectors such as software development, network administration, cybersecurity, data analytics, and IT consulting.

PEO2: Adaptation to Technological Advancements: Graduates will demonstrate the ability to adapt to rapidly changing technologies and trends in the IT industry, utilizing lifelong learning and professional development to stay current with emerging technologies such as AI, cloud computing, and the Internet of Things (IoT).

PEO3: Effective Teamwork and Communication: Graduates will be capable of working effectively in multidisciplinary teams, demonstrating strong communication, collaboration, and leadership skills to address complex IT-related challenges and contribute to organizational success.

PEO4: Ethical and Responsible Practice: Graduates will apply ethical principles and a sense of responsibility to their professional work, ensuring that technology is used in a manner that is socially, economically, and environmentally sustainable, while adhering to legal and regulatory frameworks.

PEO5: Entrepreneurial and Research Mindset: Graduates will exhibit an entrepreneurial mindset and the ability to engage in research and development activities, contributing innovative solutions to solve real-world problems, and potentially launching new IT-based ventures or pursuing higher education opportunities.

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PROGRAMME SPECIFIC OUTCOMES

PSO1: Understand the Opportunities and Challenges in Industry and to equip the students accordingly

PSO2: Apply effectively the principles and methods of Computer Technology to a wide range of applications.

PSO3: Apply advanced algorithmic and mathematical concepts to the design and analysis of software.

PSO4: Get proficiency of computing, and to prepare them for a continued professional development.

PSO5: Apply computing principles and software engineering methodologies to develop efficient, scalable, and secure software solutions for real-world problems.

PSO6: Design, manage, and optimize databases and computer networks to ensure secure and reliable data management and communication.

PSO7: Develop logical and analytical thinking skills to solve computational problems and optimize software performance.

PSO8: Demonstrate ethical responsibility, teamwork, and leadership in IT projects while adhering to professional standards and best practices.

PSO9: Foster innovation, entrepreneurship, and continuous learning to stay updated with evolving technology trends and industry demands.

PSO10: Adapt to and integrate emerging technologies such as Artificial Intelligence, Cloud Computing, IoT, and Cybersecurity in software solutions.

Program Outcome

PO1: 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.

PO2: Identify, formulate, research literature, and solve complex Computing problems reaching substantiated conclusions using fundamental principles of Mathematics, Computing sciences, and relevant domain disciplines.

PO3: 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.

PO4: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.

PO5: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

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PO6: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practice.

PO7: Recognize the need, and have the ability, to engage in independent learning for continual development as a Computing professional.

PO8: Demonstrate knowledge and understanding of 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.

PO9: Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.

PO10: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practice.

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MCA Year 1- Semester I								
Theory								
S. No.	**Course Code**	**Course Title**	**Hours**		**Marks**			**Credits**
			L	**P**	**IA**	**ETE**	**Total**	
1	MCA-101	Mathematical Foundation: Computer Science	3	0	30	70	100	3
2	MCA-102	Programming in C	3	0	30	70	100	3
3	MCA-103	Operating System	3	0	30	70	100	3
4	MCA-104	Computer System & Architecture	3	0	30	70	100	3
5	MCA-105	Database Management System	3	0	30	70	100	3
6	MCA-106	Internet Programming	3	0	30	70	100	3
Practical								
1	MCA-151	C Programming Lab	0	2	30	70	100	01
2	MCA-152	SQL & PL/SQL Lab	0	2	30	70	100	01
3	MCA-153	Internet Programming Lab	0	2	30	70	100	01
Total					**270**	**630**	**900**	**21**

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SEMESTER-I

L= Lecture, **P** = Practical, **IA** = Internal Assessment, **ETE** = End Term Exam

MCA 101- Mathematical Foundations in Computer Science

UNIT I

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, equivalence implication, Normal forms, Quantifiers, universal quantifiers. **Predicates:** Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction, Automatic Theorem Proving.

UNIT II

Relations: Properties of binary Relations, equivalence, transitive closure, compatibility and partial ordering relations, Lattices, Hasse diagram. Functions: Inverse Function, Composition of functions, recursive Functions, Lattice and its Properties, Pigeon hole principles and its application.

UNIT III

Elementary Combinatorics: Basics of counting, Combinations & Permutations, with repetitions, Constrained repetitions, Binomial Coefficients, Binomial and Multinomial theorem, the principles of Inclusion – Exclusion.

UNIT IV

Recurrence Relations: Generating Functions, Function of Sequences, Calculating Coefficients of generating functions, Recurrence relations, Solving recurrence relation by substitution and Generating functions, the method of Characteristic roots, solution of non-homogeneous Recurrence Relations.

UNIT V

Graph Theory: Representation of Graphs, DFS, BFS, Spanning Trees, Planar Graphs. Graph Theory and Applications, Basic Concepts, Isomorphism and Sub graphs, Multi graphs and Euler circuits, Hamiltonian graphs, Chromatic Numbers.

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TEXT BOOKS:

1. Mathematical Foundation of Computer Science – ShahnazBathul, PHI.
2. Elements of Discrete Mathematics- A Computer Oriented Approach,C.L.Liu, D.P. Mohapatra,3rd edition,TMH.
3. Discrete Mathematics for Computer Scientists & Mathematicians, second edition, J.L.Mott, A. Kandel, T.P. Baker, PHI
4. Discrete and Combinatorial Mathematics- An Applied Introduction-5th Edition– Ralph. P.Grimaldi, Pearson Education.

REFERENCE BOOKS:

1. Discrete Mathematics and its applications, 6th edition, K.H.Rosen, TMH.
2. Discrete Mathematical Structures, Mallik and Sen, Cengage Learning.
3. Discrete Mathematical Structures, BernandKolman, Robert C. Busby, Sharon Cutler Ross, PHI/ Pearson Education
4. Discrete Mathematics with Applications, Thomas Koshy, Elsevier
5. Logic and Discrete Mathematics, Grass Man and Tremblay, Pearson Education.

COURSE OUTCOME

CO1: Identify and analyze the computing requirements of a problem and to solve those using computing principles.

CO2: Understand and Apply mathematical foundation, computing and domain knowledge for the conceptualization of computing model of problems.

CO3: Use suitable architecture or platform on design and implementation with respect to performance.

CO4: Apply the management principles with computing knowledge to manage the projects in multidisciplinary environments.

CO5: Identify opportunities and use innovative ideas to create value and wealth for the betterment of the individual and society.

CO6: Expertise in developing application with required domain knowledge

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MCA 101- Mathematical Foundations in Computer Science																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Identify and analyze the computing requirements of a problem and to solve those using computing principles.	3	2	3	3	2	2	2	2	2	2	3	2	2	2	1	2	2	3	3	3
CO2: Understand and Apply mathematical foundation, computing and domain knowledge for the conceptualization of computing model of problems.	3	3	3	3	3	2	2	2	3	3	3	3	2	2	2	2	3	2	3	2
CO3: Use suitable architecture or platform on design and implementation with respect to performance.	3	2	3	3	2	2	3	3	2	2	3	3	3	2	2	2	3	3	3	2
CO4: Apply the management principles with computing knowledge to manage the projects in multidisciplinary environments.	3	2	3	3	2	2	2	3	2	2	3	3	3	3	2	3	2	2	3	3
CO5: Identify opportunities and use innovative ideas to create value and wealth for the betterment of the individual and society.	2	2	3	3	3	3	3	3	3	2	2	2	2	2	3	3	3	3	3	3
CO6: Expertise in developing application with required domain knowledge	3	2	3	3	2	2	3	3	2	2	3	3	3	2	2	2	3	3	3	2

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MCA 102- PROGRAMMING IN C

UNIT – I

Introduction to programming – definitions and developing Algorithms and flowcharts for simple Programs. Introduction to C Programming: Origin and history of c programming character set, Identifiers and keywords data types, constants, variables, operators, special operators, constants, Expressions, compound statements, structure of C program, Input and output function.

UNIT-II

C Statements – selection statements – if nested if's, the if-else –if ladder the conditional expressions, switch statement nested switch statements, iteration statements – the for loop, for loop variations, the while loop, the do-while loop, declaring variable with in selection and iteration statements, jump statement, the return statement, the go to submit, break statement, exit ( ) function, the continue statement, expression statement. Block statements.

UNIT – III

Arrays – Array what is an array? – Array Declaration, Array Initialization – Accessing individual elements of an array – Two Dimensional Arrays – Multi Dimensional Array, Passing an array element to a function – Rules of using an array. What are strings? String I/O, string Manipulation.

UNIT – IV

Functions – The General Form of a Function, Math functions, elements of function, function categories, types of functions, Function Arguments Call by value, Call by Reference, return statement. Uses of functions. C pre – processor, storage classes – Automatic – Register, Static and external. **Pointers** – definition, pointer variables, pointer expressions, arithmetic pointers, pointers and arrays, initializing pointers and functions and problems with pointers.

UNIT – V

Structures – definition, accessing structure members, structure assignments, array of structures, passing structures, structure pointers, uses of structures **Unions** – definitions, difference between structure and union, type def. **Files** – introduction to streams and files, basics of files – file pointer, opening and closing files, writing and reading character, file functions.

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Text Books:

1. Let Us C by Yashwanth Kanethar.
2. "Programming in ANSI C" by E. Balaguruswamy.

REFERENCE BOOKS:

1. Complete Reference of C++ by Herbert Schilde.

Course Outcome

CO1: Illustrate the flowchart and designing an algorithm for a given problem to develop c programs using operators.
CO2: Develop conditional and iterative statements to write c programs.
CO3: Exercise user defined functions to solve real time problems.
CO4: C programs that use pointers to access arrays ,strings and functions.
CO5: Exercise user defined data types including structures and unions to solve problems.
CO6: Exercise files concept to show input and output of files in c.
CO7: Learns the basic computer language
CO8: To inculcate logical thinking amongst the young minds.

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MCA 102- PROGRAMMING IN C																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Illustrate the flowchart and designing an algorithm for a given problem to develop c programs using operators.	3	2	2	2	2	1	2	2	3	2	3	2	2	2	1	2	2	2	3	2
CO2: Develop conditional and iterative statements to write c programs.	2	3	2	2	1	2	2	3	2	2	2	3	3	2	1	2	2	2	2	2
CO3: Exercise user defined functions to solve real time problems.	3	3	3	2	1	2	2	3	3	3	3	3	2	2	2	2	2	2	3	3
CO4: C programs that use pointers to access arrays ,strings and functions.	3	3	2	2	1	2	3	2	2	2	3	2	3	2	2	3	2	2	3	2
CO5: Exercise user defined data types including structures and unions to solve problems.	3	3	2	3	2	2	2	3	3	2	3	3	3	3	2	2	2	3	2	3
CO6: Exercise files concept to show input and output of files in c.	3	3	2	2	1	2	3	2	2	2	3	2	3	2	2	3	2	2	3	2
CO7: Learns the basic computer language	3	3	2	3	2	2	2	3	3	2	3	3	3	3	2	2	2	3	2	3
CO8: To inculcate logical thinking amongst the young minds.	3	3	3	2	1	2	2	3	3	3	3	3	2	2	2	2	2	2	3	3

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MCA 103- OPERATING SYSTEM

UNIT -I

Operating system concepts: OS definition and services; Types and features : batch systems, multiprogramming, multitasking, parallel systems, distributed systems, real-time systems, time-sharing systems, PC systems; System Calls types, System Programs

UNIT- II

Process vs. Thread: process states, process control block; inter-process communication; Process Synchronization:, Classical problems of synchronization; CPU Scheduling: Criteria; Algorithms: FCFS, SJF, Priority, Round- Critical section problem and solution criteria, Semaphores Robin, Real-time.

UNIT -III

Memory Management: Paging and Segmentation approaches, virtual memory, Demand Paging and Page Replacement algorithms; Deadlocks: necessary conditions, prevention, avoidance and recovery, banker's algorithm.

UNIT- IV

File Management: File System Structure, allocation methods: Contiguous allocation, Linked allocation, indexed allocation: free space management: Bit vector, linked-list, grouping, counting: Directory implementation: Linear List, Hash table.
Device Management: Disk structure, Disk scheduling:, Selecting Disk Scheduling algorithm.

UNIT -V

UNIX: Essential commands and utilities, Unix files, directory structure, file security, pipe, filter, Bourne shell programming features, systems calls classification and basics (reg. file manipulation, process, signal and IPC); Linux: System components, Process management, scheduling, memory management, Networking software layers, Security, various editors, I/O devices, IPC .

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TEXT BOOKS:

1. Andrew S Tanenbaum , " Distributed Operating Systems " , Pearson Education India, 2001.

REFERENCES:

1. Mukesh Singhal, Niranjan G Shivratri , " Advanced Concepts in Operating Systems", McGraw Hill International, 1994.
2. Pradeep K Sinha , " Distributed Operating Systems Concepts and Design ",PHI, 2002.

Course Outcome

CO1: To understand the basic concepts and working procedure of various Operating Systems.

CO2: Understand the basics of operating systems like kernel, shell, types and views of Operating systems.

CO3: Describe the various CPU scheduling algorithms and remove deadlocks.

CO4: To use the computer system resources in an efficient way.

CO5: Explain various memory management techniques and concept of thrashing

CO6: Use disk management and disk scheduling algorithms for better utilization of external memory.

CO7: To facilitate with effective development and implementation of new system functions.

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MCA 103- OPERATING SYSTEM																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: To understand the basic concepts and working procedure of various Operating Systems.	3	2	3	2	2	2	2	2	2	2	3	2	2	3	1	2	2	2	3	2
CO2: Understand the basics of operating systems like kernel, shell, types and views of Operating systems.	3	3	2	2	1	2	3	2	3	2	3	2	2	2	2	2	3	2	3	2
CO3: Describe the various CPU scheduling algorithms and remove deadlocks.	3	3	2	3	2	2	3	3	2	3	3	3	3	3	2	3	2	3	3	2
CO4: To use the computer system resources in an efficient way.	3	3	3	3	2	2	2	2	2	2	3	2	3	3	2	3	3	2	3	2
CO5: Explain various memory management techniques and concept of thrashing	3	3	3	3	3	3	3	2	2	2	3	3	2	3	2	2	3	3	3	2
CO6: Use disk management and disk scheduling algorithms for better utilization of external memory.	3	2	3	2	2	2	2	2	2	2	3	2	2	3	1	2	2	2	3	2
CO7: To facilitate with effective development and implementation of new system functions.	3	3	2	2	1	2	3	2	3	2	3	2	2	2	2	2	3	2	3	2

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MCA 104- COMPUTER SYSTEM & ARCHITECTURE

UNIT -I

Digital Logic Circuits: Digital Computers, Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Flip Flops, Sequential Circuits. Digital Components: Integrated Circuits, Decoder, Multiplexers, 'Registers, Shift Registers, Binary counter, Memory unit. Data Representation: Data types, Complements, Fixed and Floating Point Representation, Other binary codes and error Detection codes.

UNIT –II

Register Transfer and Micro operations:. Register Transfer language, Register transfer, Bus and Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operations and Arithmetic logic shift unit. Basic Computer Organization and Design: Instruction codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycles, Memory Reference Instructions, Input, Output and Interrupts, Design of Accumulator logic.

UNIT –III

Programming the Basic Computer: Introduction, Machine Language, Assembly Language, The Assembler, Programming Arithmetic and Logic Operations, Subroutines and input - output ,Programming. Micro programmed Control: Control Memory, Address Sequencing, Micro program Example, Design of Control Unit.

UNIT –IV

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation,
Program Control, RISC. Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Computer Arithmetic: Addition and Subtraction, Multiplication algorithms, Division Algorithms, Floating point arithmetic operations, decimal arithmetic unit, and decimal arithmetic operations.

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UNIT –V

Input -Output organization: Peripheral Devices, I/O output interface, Asynchronous data transfer, Modes of transfer, Priority Interrupt, DMA, Input output Processor, Serial Communication. Memory Organization: Memory Hierarchy, Main Memory, Cache Memory.

TEXT BOOKS:

1. M. Morris Mano, "Computer System Architecture", Pearson Asia / Prentice Hall, Third edition, 1993.

REFERENCES:

1. Sivarama P Dandamudi "Fundamentals of Computer Organization and Design", Springer/ Dream tech Publishers, 2003.
2. William Stallings, "Computer Organization & Architecture", Pearson Education, Sixth: Edition, 2003.

Course Outcome

CO1: Understand the theory and architecture of central processing unit.
CO2: Analyze some of the design issues in terms of speed, technology, cost, performance.
CO3: Design a simple CPU with applying the theory concepts.
CO4: Use appropriate tools to design verify and test the CPU architecture.
CO5: Learn the concepts of parallel processing, pipelining and interprocessor communication.
CO6: Understand the architecture and functionality of central processing unit.
CO7: Exemplify in a better way the I/O and memory organization.
CO8: Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.

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MCA 104- COMPUTER SYSTEM & ARCHITECTURE																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Understand the theory and architecture of central processing unit.	3	3	2	2	2	2	2	2	2	2	3	3	2	2	2	2	2	2	3	2
CO2: Analyze some of the design issues in terms of speed, technology, cost, performance.	3	3	3	2	2	2	3	3	2	2	3	3	3	2	2	2	2	2	3	3
CO3: Design a simple CPU with applying the theory concepts.	3	3	3	3	2	2	3	3	2	2	3	3	3	2	2	2	3	3	3	2
CO4: Use appropriate tools to design verify and test the CPU architecture.	3	3	3	3	2	2	3	3	3	3	3	3	3	2	2	3	3	2	3	2
CO5: Learn the concepts of parallel processing, pipelining and interprocessor communication.	3	3	3	3	3	2	3	3	2	3	3	3	2	3	3	3	3	3	3	3
CO6: Understand the architecture and functionality of central processing unit.	3	3	3	3	3	3	3	2	2	2	3	3	2	3	2	2	3	3	3	2
CO7: Exemplify in a better way the I/O and memory organization.	3	2	3	2	2	2	2	2	2	2	3	2	2	3	1	2	2	2	3	2
CO8: Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.	3	3	2	2	1	2	3	2	3	2	3	2	2	2	2	2	3	2	3	2

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MCA 105- DATABASE MANAGEMENT SYSTEM

UNIT-I

Introduction; An example; Characteristics of Database approach; Actors on the screen; Workers behind the scene; Advantages of using DBMS approach; A brief history of database applications; when not to use a DBMS .Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

UNIT-II

Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

UNIT-III

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

UNIT-IV

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL Queries. Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL; Additional features of SQL; Database programming issues and techniques; Embedded SQL, Dynamic SQL; Database stored procedures and SQL /PSM.

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UNIT-V

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form. The ACID Properties; Transactions and Schedules; Concurrent Execution of Transactions; Lock- Based Concurrency Control; Performance of locking; Transaction support in SQL; Introduction to crash recovery.

TEXT BOOKS:

1. Fundamentals of Database Systems, Ramez A. Elmasri, Shamkant Navathe,5th Ed(Pearson)
2. Database System Concepts By Korth, Silberschatz, Sudarshan (Mcgraw Hill)
3. An Introduction to Database Systems By Bipin C. Desai (Galgotia Publication.)
4. SQL, PL/SQL Programming By Ivan Bayross (BPB)
5. Commercial Application Development Using Oracle Developer 2000 By Ivan Bayross (BPB)

REFERENCES:

1. SQL, PL/SQL Programming By Ivan Bayross (BPB)
2. Commercial Application Development Using Oracle Developer 2000 By Ivan Bayross (BPB)

Course Outcome

CO1: Have a broad understanding of database concepts and database management system software including a high-level understanding of major DBMS components and their functions.

CO2: Able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model so as to successfully design a complete application.

CO3: Understand Data Normalization and its usage in database design so as to successfully design a complete application

CO4: Learn transaction properties and types in a DBMS including concurrency control and recovery.

CO5: Able to write SQL statements to create tables and indexes, set constraints, insert/update/delete data, and query data in a relational DBMS thereby building a successful application.

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MCA 105- DATABASE MANAGEMENT SYSTEM																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Have a broad understanding of database concepts and database management system software including a high-level understanding of major DBMS components and their functions.	3	2	2	2	1	2	2	2	2	2	3	2	2	3	1	2	2	2	3	2
CO2: Able to model an application's data requirements using conceptual modeling tools like ER diagrams and design database schemas based on the conceptual model so as to successfully design a complete application.	3	3	3	2	2	1	2	2	3	2	3	3	3	3	2	3	2	2	3	2
CO3: Understand Data Normalization and its usage in database design so as to successfully design a complete application	3	3	2	2	1	2	2	2	3	2	3	3	3	2	2	2	3	2	2	3
CO4: Learn transaction properties and types in a DBMS including concurrency control and recovery.	3	3	2	2	1	2	2	3	2	3	2	3	2	3	2	2	3	3	2	3
CO5: Able to write SQL statements to create tables and indexes, set constraints, insert/update/delete data, and query data in a relational DBMS thereby building a successful application.	3	3	3	3	2	3	3	2	3	2	3	3	3	3	2	3	3	2	3	3

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MCA 106- WEB TECHNOLOGY

UNIT- I

Internet Basics: Evolution of Internet, Basic internet terms and applications. ISP, Anatomy of an e-mail Message, basic of sending and receiving, E-mail Protocol; Mailing List-Subscribing, Unsubscribing.

UNIT- II

Introduction to World Wide Web and its work, Web Browsers, Search Engine, Downloading, Hyper Text Transfer Protocol (HTTP), URL, Web Servers, FTP, Web publishing- Domain Name Registration, Space on Host Server for Web Site, Maintain and Updating.

UNIT- III

HTML: Elements of HTML & Syntax, Comments, Headings, Paragraph, Span, Pre Tags, Backgrounds, Formatting tags, Images, Hyperlinks, div tag, List Type and its Tags, Table Layout, div, Use of Forms in Web Pages.

UNIT-IV

CSS: Introduction to Cascading Style Sheets, Types of Style Sheets (Inline, Internal and External), using Id and Classes, CSS properties: Background Properties, Box Model Properties, Margin, Padding, List Properties, Border Properties.

UNIT-V

Java Script: Introduction to Client Side Scripting, Introduction to Java Script, Comments, Variables in JS, Global Variables, Data types, Operators in JS, Conditions Statements (If, If Else, Switch), Java Script Loops (For Loop, While Loop, Do While Loop), JS Popup Boxes (Alert, Prompt, Confirm), JS Events, JS Arrays, JS Objects.

TEXT BOOKS:

1. Internet and Web Page Designing By V.K Jain (BPB)
2. Web Enabled Commercial Application Development Using HTML, DHTML , java script, Perl CGI By Ivan Bayross (BPB)

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REFERENCES:

1. Thomas A. Powell , "HTML: The Complete Reference", Osborne/McGraw-Hill
2. Deitel, Deitel and Nieto: Internet & WWW. How to program, 2nd Edition, Pearson Education Asia.
3. Bayross, "Web Enabled Commercial Applications Development Using HTML, DHTML, Java Script, Perl CGI," Third Edition, BPB Publications.

Course Outcome

CO1: Understand basics of web technologies.
CO2: Create interactive web applications using latest web technologies.
CO3: Publish and maintain interactive web applications.
CO4: Use XML standards and tools towards smart web applications.

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MCA 106- WEB TECHNOLOGY																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Understand basics of web technologies.	3	2	2	2	2	2	2	2	2	3	2	2	3	2	2	2	2	2	2	2
CO2: Create interactive web applications using latest web technologies.	3	3	2	2	2	2	2	2	3	3	3	2	2	2	2	3	3	3	3	2
CO3: Publish and maintain interactive web applications.	3	3	3	2	2	2	2	2	3	3	2	3	3	2	2	2	3	2	3	2
CO4: Use XML standards and tools towards smart web applications.	3	3	3	2	2	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3

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SEMESTER-II

MCA Year 1- Semester II								
Theory								
S. No.	**Course Code**	**Course Title**	**Hours**		**Marks**			**Credits**
			L	**P**	**IA**	**ETE**	**Total**	
1	MCA-201	Object Oriente Programming with ++	3	0	30	70	100	3
2	MCA-202	Computer Networks	3	0	30	70	100	3
3	MCA-203	Data Structures	3	0	30	70	100	3
4	MCA-204	Software Engineering	3	0	30	70	100	3
5	MCA-205	Java Programming	3	0	30	70	100	3
6	MCA-206	Business Informatics	3	0	30	70	100	3
Practical								
1	MCA-251	Object oriented Programming with C++ Lab	0	2	30	70	100	01
2	MCA-252	Data Structure Lab	0	2	30	70	100	01
3	MCA-253	Java Programming Lab	0	2	30	70	100	01
		Total			**270**	**630**	**900**	**21**

L= Lecture, **P** = Practical, **IA** = Internal Assessment, **ETE** = End Term Exam

Note:

Mandatory Summer Training: 30 Working Days Summer Training during Semester Break, of 100 Marks. Evaluation will be done in Semester-III Examinations.

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 201 – OBJECT ORIENTED PROGRAMMING WITH C++

UNIT- I

Object Oriented System: Difference Between Procedural and Object Oriented Languages, Object Oriented Paradigm, Inheritance, Polymorphism, Abstraction, Encapsulation, Benefits and Application of Oops. Introduction to C++: Character Set, Token, Constants, Variables and Data Types, Enumeration Types, Operators, Expressions, Operator Precedence and Associatively, , Input, Output, Conditional Statements, Scope of Variables, Type Conversion.

UNIT- II

Iteration, Break, Continue, goto; Pointers: Introduction, implementation advantage and disadvantage. Functions - Standard and User-Defined Function, Recursive Function, Passing By Value And Reference, Function Overloading Pointer and Function: Function Returning Pointer, Passing pointer as argument, Reference and Functions. Structures and Pointers.

UNIT-III

Array: introduction, advantage, One, Two and Multidimensional, Passing Array to a Function, Array and Pointers: Pointer to One and Two Dimensional Arrays, Array of Pointers. Dynamic Arrays, String Processing. Class: Introduction to Class and Object, Declaring Members and Methods in a class, declaring objects.

UNIT-IV

Functions and objects, Inline Function, Friend Functions and Its Usage, Abstract Class, Function Overriding. Constructor and Destructor- Needs and Its Usage, Types of Constructors, Destructor, Static Data Members and Methods. Inheritance - Need of Inheritance, Types of Inheritance and its implementation.

UNIT- V

Operator Overloading: Need and Rules of Operator Overloading, Overloading Through Member Function and Friend Function. Compile Time and Run Time Polymorphism- Virtual Function and virtual class.

TEXT BOOKS:

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1. Object Oriented Programming With C++ By E. Balagurusamy (Tata Mcgraw Hill)
2. C++ The Complete Reference By Herbert Sehildt (Tata Mcgraw Hill)

REFERENCES:

1. Object Oriented Programming With C++ By Schaum Series (Tata Mcgraw Hill)

Course Outcome

CO1: To understand a software development problem and express it precisely.
CO2: To identify the objects of a system and to establish their relationships.
CO3: To implement a module structure this executes efficiently.
CO4: Able to generate a design which can be converted into applications with OO languages

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MCA 201 – OBJECT ORIENTED PROGRAMMING WITH C++																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: To understand a software development problem and express it precisely.	2	2	2	2	3	2	2	3	2	2	3	2	2	2	2	2	3	2	2	2
CO2: To identify the objects of a system and to establish their relationships.	2	3	3	2	3	3	2	3	2	3	3	3	2	2	2	3	3	3	3	3
CO3: To implement a module structure this executes efficiently.	3	3	2	2	3	2	3	3	3	3	3	2	3	3	3	2	3	2	3	3
CO4: Able to generate a design which can be converted into applications with OO languages	3	2	3	2	3	3	2	3	3	2	3	3	3	2	3	3	3	2	2	3

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MCA 202 – COMPUTER NETWORK

UNIT - I

Data Communication and Networking: Overview, Network Types, LAN Technologies, Topologies, Models- OSI Model, TCP/IP Stack

UNIT - II

Physical Layer: Introduction, Digital Transmission, modes, digital to digital, analog to digital, Analog Transmission, digital to analog, analog to analog, Transmission media, Wireless Transmission, Switching techniques: Circuit Switching, Packet switching, Message switching.

UNIT- III

Data Link Layer: Introduction, Data Link Control: Line Discipline- Enq /Ack, Poll/Select, Flow Control: Stop And Wait, Sliding Window, Error Control: ARQ, Stop and Wait ARQ, Sliding Window ARQ.

UNIT - IV

Network Layer: Introduction, Network Addressing, Routing, Internetworking, Tunneling, Packet Fragmentation, Network Layer Protocols, ARP, ICMP, IPv4, IPv6

UNIT-V

Transport Layer: Introduction, Transmission Control Protocol, User Datagram Protocol Application Layer: Introduction, Client-Server Model, Application Protocols

TEXT BOOKS:

1. Computer Forensics by Marie- Helen Maras
2. Data Communication and Networking By Forozan (Tata McGraw Hill)
3. Data Communication And Computer Networks By Dr. Madhulika Jain, Satish Jain (BPB)
4. William Stallings, "Data and Computer Communications", Pearson Education, 2008.
5. Rajneesh Agrawal and Bharat Bhushan Tiwari, "Data Communication and Computer Networks", Vikas Publishing house Ltd. , 2005.

REFERENCES:

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

1. S. Tanenbaum, "Computer Networks", Fourth Edition, Pearson Education.
2. Leon-Gracia and I. Widjaja, "Communication Networks", Tata McGraw Hill, 2004.

Course Outcome

CO1: Describe communication models TCP/IP, ISO-OSI model, network topologies along with communicating devices and connecting media.

CO2: Apply knowledge of error detection, correction and learn concepts of flow control along with error control.

CO3: Classify various IP addressing techniques, subnetting along with network routing protocols and algorithms.

CO4: Understand various transport layer protocols and their design considerations along with congestion control to maintain Quality of Service.

CO5: Understand applications-layer protocols and elementary standards of cryptography and network security

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MCA 202 – COMPUTER NETWORK																				
COs \ POs / PSOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1: Describe communication models TCP/IP, ISO-OSI model, network topologies along with communicating devices and connecting media.	3	2	2	2	3	2	2	2	2	2	3	2	2	2	2	2	3	2	2	3
CO2: Apply knowledge of error detection, correction and learn concepts of flow control along with error control.	3	3	2	3	3	2	2	3	2	3	3	3	3	3	2	3	3	2	3	3
CO3: Classify various IP addressing techniques, subnetting along with network routing protocols and algorithms.	3	3	2	2	3	3	2	3	3	3	3	2	3	3	2	2	3	2	3	3
CO4: Understand various transport layer protocols and their design considerations along with congestion control to maintain Quality of Service.	3	3	3	2	3	2	3	3	3	3	3	3	3	2	2	3	3	2	3	3
CO5: Understand applications-layer protocols and elementary standards of cryptography and network security	3	3	3	3	3	3	2	2	2	3	3	3	3	3	2	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 203 – DATA STRUCTURE

UNIT- I

Primitive and Composite Data Types, Time and Space Complexity of Algorithms, Stack and Primitive Operation on Stack. Applications- Infix, Postfix, Prefix and Recursion. Queues, Primitive Operations on Queues, Circular Queue, De Queue and Priority Queue.

UNIT- II

Basic Operation on Linked List, Circular Linked List, Doubly Linked List, Linked Representation of Stack and Queue, Application of Linked List.

UNIT- III

Trees: Basic Terminology, Binary Trees, Tree Representation as Array and Linked List, Basic Operation on Binary Tree, Traversal of Binary Tree – In Order, Preorder, Post Order, Application of Binary Tree, Threaded Binary Tree, B-Tree and Height Balance Tree.

UNIT-IV

Sequential Search, Binary Search, Insertion Sort, Selection Sort, Quick Sort, Bubble Sort, Heap Sort, Radix Sort Comparison of Sorting Methods.

UNIT-V

Hash Table, Collision Resolution Techniques. Introduction to Graphs, Definition, Terminology, Directed, Undirected, Weighted Graph, Representation of Graphs, Graph Traversal – Depth First and Breadth First, Spanning Trees, Minimum Spanning Trees, Shortest Path Algorithm (Kruskal and Prim's Algorithm).

TEXT BOOKS:

1. Expert Data Structure with 'C' By R.B Patel (Khanna Book Publishing Co.(P))
2. Data Structure By Lipschutz (Tata McGraw Hill)
3. Data Structure By Yashvant Kanitkar (BPB)

REFERENCES:

1. An Introduction to Data Structures with Applications, By Jean-Paul Tremblay, Paul G. Sarerson (Tata McGraw Hill)
2. Data Structure Using C and C++ By Yedidyahlangsam, Moshe J. Augenstein, Arora M. Tenenbaum (Prentice- Hall India)

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Course Outcome

CO1: Understand the classification of data structures and Knowledge of basic and dynamic data structures..

CO2: Compare and contrast various data structures and design techniques in the area of Performance and Memory Representation.

CO3: Ability to evaluate algorithms and data structures in terms of time and complexity of basic operations.

CO4: Ability to analyze algorithms for stack, queue and linked list, trees, and graphs and compare their Performance and tradeoffs.

CO5: Incorporate data structures into the applications such as binary search trees, AVL tree and B trees.

CO6: Ability to implement Data Structure Traversal such as Array, Stack, Queue, Linked List, Tree and Graph.

CO7: Apply and implement learned algorithm design techniques and data structures to solve problems.

CO8: Understand the various searching and sorting techniques

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MCA 203 – DATA STRUCTURE																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Understand the classification of data structures and Knowledge of basic and dynamic data structures..	3	3	2	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2	2	3
CO2: Compare and contrast various data structures and design techniques in the area of Performance and Memory Representation.	3	3	3	2	3	2	2	2	2	3	3	3	3	3	2	3	2	2	2	3
CO3: Ability to evaluate algorithms and data structures in terms of time and complexity of basic operations.	3	3	2	3	3	2	3	2	2	3	3	3	3	2	2	3	3	2	3	3
CO4: Ability to analyze algorithms for stack, queue and linked list, trees, and graphs and compare their Performance and tradeoffs.	3	3	2	3	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO5: Incorporate data structures into the applications such as binary search trees, AVL tree and B trees.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6: Ability to implement Data Structure Traversal such as Array, Stack, Queue, Linked List, Tree and Graph.	3	3	2	2	3	2	2	2	2	2	3	3	2	3	2	3	2	2	2	3
CO7: Apply and implement learned algorithm design techniques and data structures to solve problems.	3	3	3	2	3	2	2	2	2	3	3	3	3	3	2	3	2	2	2	3
CO8: Understand the various searching and sorting techniques	3	3	2	3	3	2	3	2	2	3	3	3	3	2	2	3	3	2	3	3

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MCA 204– SOFTWARE ENGINEERING

UNIT- I

Software Engineering: Software, Software Process, Process Characteristics, Software Process Model- Linear Sequential Model, Prototyping Model, Spiral Model. Software Quality, McCall's Quality Factors. Software Requirement Analysis and Specification (SRS): Need, Characteristics and Components.

UNIT- II

Cost Estimation: COCOMO Model, Designing Concepts: Design Principles, Module level concepts- Cohesion and Coupling, Design notations and specifications, Verification, Metrics.

UNIT-III

Object Oriented Design: Concepts, Design Notation and Specification, Design methodology, metrics. Debugging Process: Information Gathering, Fault Isolation, Fault Confirmation, Documentation, Fixing fault isolation.

UNIT- IV

Testing: Testing Fundamental, Functional Testing (Black Box), Structural Testing (White Box), Alpha And Beta Testing, Testing Object Oriented Programs, Testing Process: Comparison of Different Testing, Level of Testing. Project management for special classes of software projects: Using CASE tools, CBSE.

UNIT – V

UML: An overview of UML- UML notations, UML Class diagrams- association, multiplicity, generalization, aggregation, interfaces.

TEXT BOOKS:

1. Software Engineering: A Practitioner's Approach by Roger S. Pressman(McGraw Hill)
2. An Integrated Approach to Software Engineering By PankajJalote, (Narosa Publishing House)

REFERENCES:

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

1. Object-Oriented Software Engineering: Practical Software Development using UML and Java By Timothy C. Lethbridge, Robert Laganière (McGraw Hill)
2. Object-Oriented Software Engineering Using UML, Patterns, and Java By Bernd Bruegge & Allen H. Dutoit (Prentice Hall)

Course Outcome

CO1: Understand the basic concepts of software engineering and software development life cycle models.
CO2: Comprehend the concepts of requirement analysis and specification and software design.
CO3: Learn Function-oriented software design and Object Oriented software development and to draw various Diagrams using UML.
CO4: Understand User interface design and various testing.
CO5: Recognize Software Quality, Reliability Management, Software Maintenance and CASE tools.

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MCA 204– SOFTWARE ENGINEERING																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Understand the basic concepts of software engineering and software development life cycle models.	3	2	2	2	3	2	3	2	3	2	3	3	2	2	3	2	3	2	3	3
CO2: Comprehend the concepts of requirement analysis and specification and software design.	3	3	3	3	3	2	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO3: Learn Function-oriented software design and Object Oriented software development and to draw various Diagrams using UML.	3	3	2	3	3	2	3	3	3	3	3	3	3	3	2	3	3	3	3	3
CO4: Understand User interface design and various testing.	3	2	2	3	3	2	3	3	2	2	3	3	3	3	3	2	3	2	3	2
CO5: Recognize Software Quality, Reliability Management, Software Maintenance and CASE tools.	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 205– JAVA PROGRAMMING

UNIT-1

Java Evolution and Overview of Java Language: How Java differs from C and C++,Java and Internet, Java and World Wide Web, Introduction, Simple Java Program, More of Java, An Application with Two Classes, Java Program Structure, Java Tokens, Java Statements, Implementing a Java Program, Java Virtual Machine, Command Line Arguments, Programming Style. **Constants, Variables, and Data Types:** Introduction, Constants, Variables, Data Types, Declaration of Variables, Giving Values of Variables, Scope of Variables, Symbolic Constants, Type Casting, Getting Values of Variables, Standard Default Values.

UNIT-II

Operators and Expressions: Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators, Special Operators, Arithmetic Expressions, Evolution of Expressions, Precedence of Arithmetic Operators, Type Conversion in Expressions, Operator Precedence and Associativity, Mathematical Functions.

UNIT-III

Decision Making and Branching: Introduction, Decision Making with if Statement, Simple if Statement, The if... else Statement, Nesting of if ... else Statements, The else if Ladder, The switch Statement, The?: Operator.
Decision Making and Looping: Introduction, The while Statement, The do Statement, The for Statement, Jumps in Loops, Labeled Loops.

UNIT-IV

Classes, Objects and Methods: Introduction, Defining a Class, Adding Variables, Adding Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods, Inheritance: Extending a. Class, Overriding Methods, final Variables and Methods, Final Classes, Finalizer Methods, Abstract Methods and Classes, Visibility Control.

Arrays, String and Vectors: Arrays, One-Dimensional Arrays, Creating an Array, Two-Dimensional Arrays, Strings, Vectors, Wrapper Classes. Interfaces: Multiple Inheritance: Introduction, Defining Interfaces, Extending Interfaces, implementing Interfaces.

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Packages: Putting Classes Together: Introduction, Java API Packages, Using system Packages, Naming Conventions, Creating Packages, Accessing a Packages, Using a Package, Adding a Class to a Package. Multithreaded Programming: Introduction, Creating Threads, Extending the Thread Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, and Synchronization.

UNIT-V

Managing Errors and Exceptions: Introduction, Types of Errors, Exceptions, Syntax of Exception, Different classes used to handle the Exception. Applet Programming: Introduction, How Applets Differ from Application, Preparing to Write Applets, Building Applet Code, Applet Life Cycle, Creating an Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, More About Applet Tag, different geometrical methods and its implementation. Use of Color and Font class.

Managing Input/output Files in Java: Introduction, Concepts of Streams Stream Classes, Byte Stream Classes, Character Stream Classes, Using Streams, and Other Useful I/O Classes, using the File Class, Input/output Exceptions, and Creation of Files.

TEXT BOOKS:

1. E. Balagurusamy, Programming with Java, A Primer Second Edition, Tata McGraw Hill, New Delhi.

REFERENCES:

1. H.M.Deitel & P.J.Deitel- JA V A- How to Program, 5th Edn, Pearson Education, New Delhi-2004.
2. P.Naughton and H. Schildt-JAVA: The Complete Reference, TMH, New Delhi 2005.
3. D.Jana- Java and Object Oriented Programming Paradigm, PHI, New Delhi-2005.

Course Outcome

CO1: Understand & analyze the Java features and Program Structure.

CO2: Apply the concepts of encapsulation in classes and objects.

CO3: Classify and implement the types of Inheritance & Packages.

CO4: Differentiate and demonstrate the types in Thread creation and Exception Handling.

CO5: Create the Applet Program and apply the Collection Framework.

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MCA 205– JAVA PROGRAMMING																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Understand & analyze the Java features and Program Structure.	3	3	2	2	3	2	3	2	3	2	3	3	3	2	3	2	3	2	3	3
CO2: Apply the concepts of encapsulation in classes and objects.	3	3	2	3	3	2	3	3	3	2	3	3	3	3	3	2	3	2	3	3
CO3: Classify and implement the types of Inheritance & Packages.	3	3	3	2	3	2	3	2	3	3	3	3	3	3	3	2	3	2	3	2
CO4: Differentiate and demonstrate the types in Thread creation and Exception Handling.	3	3	3	3	3	2	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO5: Create the Applet Program and apply the Collection Framework.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 206– BUSINESS INFORMATICS

UNIT-I

Business Environment and Dependence on IT: Introduction to Business Informatics, Organizational Structure and Design, Dependence on Technology, Integrating Technology with Business Environment IT and Corporate Strategy, Sustaining a Competitive Edge through application of IT.

UNIT-II

E-Commerce: Definition, Objectives, components, Advantages and disadvantages, Scope, E-Commerce Models, E-Commerce Opportunities for Industries, Growth of E-Commerce, e-Commerce Applications- E-Marketing, E-Customer Relationship Management, E-Supply Chain Management, E-Governance, E-Buying, E-Selling, E-Banking, E-Retailing.

UNIT-III

E-Payments and Security issues in E-Commerce: Introductions, Special features, Types of E-Payment Systems (EFT, E-Cash, E- Cheque, Credit/Debit Card, Smart Card, Digital Tokens and Electronic Purses/ Wallets), Security risk of E-Commerce, Types of threats, Security Tools, Cyber Laws, Business Ethics.

UNIT-IV

ERP: Introduction, Needs and Evolution of ERP Systems, ERP Domain, ERP Benefits, ERP and Related Technologies, Relevance to Data Warehousing and Data Mining, ERP Drivers, Evaluation Criterion for ERP product, ERP Life Cycle: Adoption decision, Acquisition, Implementation, Use & Maintenance, Evolution and Retirement Phases, ERP Units ,ERP Success & Failure Factors.

UNIT-V

Information Systems: Introduction, Categories of System: Open, Closed, Physical, Abstract, Dynamic, Static etc., Types of Information Systems: TPS, MIS, DSS, OLAP, OLTP, Expert System, Internet Based Systems, Learning Management Systems, Business Process

TEXT BOOKS:

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

1. Ravi Kalakota, "Electronic Commerce: A Manager's Guide", Addison-Wesley Professional, Edition 2012.
2. Henry C. Lucas, Information Technology for Management, McGraw Hill, International Edition, July 2001.
3. Kenneth C. Laudon& Jane P. Laudon, Management Information System, Global Edition, Pearson Education, 2009.

REFERENCES:

1. Dr. K Abirami Devi & Dr. M Alagammai, "E-Commerce Essentials", Margham Publication, 2012.
2. Kenneth C. Laudon, Karol Traver, "E-Commerce 2014", Prentice Hall Publication, 2013.
3. Enterprise Resource Planning Systems System, Lifecycle, Electronic Commerce and Risk by Daniel E.O. Leary, 2011

Course Outcome

CO1: Identify and evaluate factors that dictate leadership, administration and development of enterprises in free market economy, seen from the information technology viewpoint;

CO2: Demonstrate expertise in theoretical aspects, and especially in practical skills applicable in the fields of e-services, computer systems organization, web design, software engineering, etc.

CO3: Identify and evaluate in a critical way specific problems of business informatics, as well as effectively use technology to solve economic problems, planning and administration.

CO4: Apply and use computer analysis for enterprise functioning, reciprocal dependence and influence on political, economic and social factors;

CO5: Interpret the strategic planning of organization development in the long term and short term, by using technological means and software;

CO6: Design and interpret technological policies that encourage economic activity, business expansion and investment in new areas

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 206– BUSINESS INFORMATICS																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Identify and evaluate factors that dictate leadership, administration and development of enterprises in free market economy, seen from the information technology viewpoint;	2	2	2	3	2	3	3	2	3	3	3	2	2	2	2	2	3	3	2	3
CO2: Demonstrate expertise in theoretical aspects, and especially in practical skills applicable in the fields of e-services, computer systems organization, web design, software engineering, etc.	3	3	2	3	2	3	3	2	3	3	3	3	2	2	2	2	3	3	2	3
CO3: Identify and evaluate in a critical way specific problems of business informatics, as well as effectively use technology to solve economic problems, planning and administration.	3	3	2	2	3	3	3	2	3	3	3	3	3	2	2	3	3	3	3	3
CO4: Apply and use computer analysis for enterprise functioning, reciprocal dependence and influence on political, economic and social factors;	3	2	3	3	2	3	3	3	2	3	3	2	2	2	2	3	3	3	3	3
CO5: Interpret the strategic planning of organization development in the long term and short term, by using technological means and software;	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO6: Design and interpret technological policies that encourage economic activity, business expansion and investment in new areas	3	3	2	2	3	3	3	2	3	3	3	3	3	2	2	3	3	3	3	3

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SEMESTER-III

III-Semester (Second Year) MCA Year 2 - Semester III								
Theory								
S. No.	**Course Code**	**Course Title**	**Hours**		**Marks**			**Credits**
			L	**P**	**IA**	**ETE**	**Total**	
1	MCA-301	Cloud Computing	3	0	30	70	100	3
2	MCA-302	Windows Programming using c#	3	0	30	70	100	3
3	MCA-303	Cyber Security	3	0	30	70	100	3
4	MCA-304	Python Programming	3	0	30	70	100	3
5	MCA-305	Computer Graphics	3	0	30	70	100	3
6	MCA-306	Elective 1	3	0	30	70	100	3
Practical								
1	MCA-351	Windows programming LAB	0	2	30	70	100	01
2	MCA-352	Computer Graphics + Python Lab	0	2	30	70	100	01
3	MCA-353	Summer Industrial Training Presentation	0	2	30	70	100	01
Total					**270**	**630**	**900**	**21**

L= Lecture, **P** = Practical, **IA** = Internal Assessment, **ETE** = End Term Exam

Elective -1:

a) Data Mining and Warehousing
b) Search Engine Optimization(SEO)

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 301– CLOUD COMPUTING

UNIT- I

Introduction to Client – Server Computing, Peer-to-Peer Computing, Distributed Computing, Collaborative Computing, Cloud Computing

UNIT- II

Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud Services – SaaS, IaaS, PaaS, DaaS and VDI etc.

UNIT-III

Cloud as Web-Based Application, Cloud Service Development: Pros and Cons, Types, Software as a Service, Platform as a Service, Web Services, On-Demand computing, Discovering Cloud Services, Development Services and Tools, overview of major Cloud Service providers- Amazon Ec2, Google App Engine, IBM Clouds, and Eucalyptus etc.

UNIT-IV

Application of Cloud Computing for Centralizing Email communications, collaborating on Schedules, Calendars, To-Do Lists, Contact Lists. Cloud for the Community, Group Projects and Events; Cloud Computing for the Corporation. Cloud Computing for Schedules and Task Management, Exploring Online Scheduling Applications and Online Planning and Task Management.

UNIT-V

Cloud Computing Collaborating on Event Management, Contact Management and Collaborating on Project Management. Cloud Collaborating on Word Processing, Databases, Storing and Sharing Files; Evaluating Web Mail Services, Evaluating Web Conference Tools; Cloud computing and Social Networks, Groupware, Blogs and Wikis Data privacy and security Issues and other risks in Cloud Computing

TEXT BOOKS:

1. Cloud Computing Concepts Technology and Architecture by Thomas Erl, Prentice Hall

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2. Cloud Computing Principles and Paradigm by Rajkumar Buyya, James Broberg, Andrzej Goscinski, Wiley Publications

REFERENCES:

1. Cloud Computing Theory And Practice by Dan C. Marinescu, Morgan Kaufman Publications

Course Outcome

CO1: Understand the concepts of Cloud Computing, key technologies, Strengths and limitations of cloud computing.

CO2: Develop the ability to understand and use the architecture to compute and storage cloud, service and models.

CO3: Understand the application in cloud computing.

CO4: Learn the key and enabling technologies that help in the development of cloud.

CO5: Explain the core issues of cloud computing such as resource management and security.

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MCA 301– CLOUD COMPUTING																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Understand the concepts of Cloud Computing, key technologies, Strengths and limitations of cloud computing.	3	2	3	3	2	2	2	3	3	2	3	2	2	3	2	3	2	3	3	3
CO2: Develop the ability to understand and use the architecture to compute and storage cloud, service and models.	3	3	2	3	2	2	2	3	3	2	3	3	2	3	2	3	2	3	3	3
CO3: Understand the application in cloud computing.	2	2	2	2	3	2	2	3	2	3	3	2	2	3	2	3	3	3	2	3
CO4: Learn the key and enabling technologies that help in the development of cloud.	3	3	3	3	3	3	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO5: Explain the core issues of cloud computing such as resource management and security.	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 302– WINDOWS PROGRAMMING USING C#

UNIT-I

.Net Introduction to .Net Technology: Why .Net?, The .Net Framework Class Library, Working with the .Net FCL, Namespaces, Types of a .Net Namespace.

UNIT-II

The Visual Basic.Net Language: VB.Net Data types, Operators, Decision Statements- If..then, If..then..else, Select.. Case, Loop Statements- While, Do .. Loop, For .. Next, For Each ..Next, Arrays.

UNIT-III

OOP using VB.Net: Object Oriented features- Abstraction, Encapsulation, Polymorphism, Inheritance, Declaring Classes, Implementing Typecasting, Procedures and Functions, Optional arguments, Error handling in Procedures, Properties, Public and Private variables, Types of Properties, Polymorphism, Inheritance, Method Overriding.

UNIT-IV

Windows Form: Introduction to Class Libraries, Event and Event Handlers, Windows Application, Windows GUI, First Win Forms Application, Controls, Text controls, Selection List Controls, VB.Net is overridden, Some controls with examples. **Error handling In Windows Forms:** Types of Validations, Types of Errors, Exceptions, and Classified Runtime based Exceptions. **SDI and MDI Applications:** SDI and MDI interfaces, Characteristics of MDI components, Creating MDI Forms.

UNIT-V

Data access with ADO.Net: Overview of Microsoft Database Access Technology, ADO.Net, Creating a Database, ADO.Net Architecture, ADO.Net Class Libraries, Databound Controls, Creating a Data Set, Using XML Data.

TEXT BOOKS:

1. Beginning C# Object Oriented Programming by Syed Shanu (C# Corner)
2. Beginning C# 6 Programming with Visual Studio 2015 by Benjamin Perkins, Jacob Vibe Hammer, Jon D. Reid (Wrox)
3. C# 6.0 in a Nutshell: The Definitive Reference 6th Edition by Joseph Albahari and Ben Albahari

REFERENCES:

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1. Pro C# 5.0 and the .NET 4.5 Framework (Expert's Voice in .NET) 6th Edition by Andrew Troelsen
2. Programming C# for Beginners (Mahesh Chand)

Course Outcome

CO1: Read, write, execute, and debug C# applications
CO2: Understand variables and data types
CO3: Code decision and control structures (if, if/else, switch, while, do/while, for) and use primitive data types
CO4: Write user-defined methods
CO5: Write and manipulate arrays
CO6: Write programs using object-oriented programming techniques including classes, objects, inheritance, and polymorphism
CO7: Use graphical user interface (GUI) components
CO8: Understand C#'s Event Handling Model
CO9: Write code to access and manipulate databases

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MCA 302– WINDOWS PROGRAMMING USING C#																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Read, write, execute, and debug C# applications	3	3	2	2	3	3	3	3	3	2	3	3	3	2	3	3	3	3	3	3
CO2: Understand variables and data types	3	3	2	3	2	3	3	3	3	3	3	3	2	2	3	3	3	3	3	3
CO3: Code decision and control structures (if, if/else, switch, while, do/while, for) and use primitive data types	3	3	2	3	3	2	3	3	3	3	3	3	3	2	3	3	3	3	3	3
CO4: Write user-defined methods	3	2	3	2	3	3	3	3	3	2	3	3	3	2	3	3	3	3	3	3
CO5: Write and manipulate arrays	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3
CO6: Write programs using object-oriented programming techniques including classes, objects, inheritance, and polymorphism	3	3	2	3	2	2	2	3	3	2	3	3	2	3	2	3	2	3	3	3
CO7: Use graphical user interface (GUI) components	2	2	2	2	3	2	2	3	2	3	3	2	2	3	2	3	3	3	2	3
CO8: Understand C#'s Event Handling Model	3	3	3	3	3	3	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO9: Write code to access and manipulate databases	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 303– CYBER SECURITY

UNIT- I

Cyber Security: definition, cybercrime and information security, cybercriminals, classification of cybercrime, cybercrime Era. Cyber offences: categories of cybercrime, how criminals plan the attack, cyber stalking, cyber and cybercrime, botnets and cybercrime, Cloud Computing and cybercrime.

UNIT-II

Tools and methods used in cybercrime: phishing and Identity theft; methods of phishing, spear phishing, types of phishing scams, phishing toolkits, and spy phishing, Personally Identifiable Information, types and techniques of ID theft, password cracking, key loggers and spywares, backdoors, steganography, DoS and DoS attacks, SQL Injection, Buffer Overflow.

UNIT- III

Cybercrime on mobile and wireless devices: Security challenges posed by mobile devices, attacks on wireless networks, credit card frauds mobile and wireless era. Authentication security service, attacks on mobile phones; mobile phone theft, mobile virus, mishing, vishing, smishing, hacking Bluetooth.

UNIT-IV

Cybercrime and Cyber Security: Cyber Law, The Indian IT Act, Digital Signatures and IT Act, Cyber security and organizational implications, Cyber crisis management, Anti-Cybercrime Strategies, Cybercrime and Cyber terrorism. Cybercrime and Indian ITA 2000.

UNIT-V

Computer forensics: introduction, computer forensics and digital evidence, digital forensics life cycle, computer forensics and steganography, Relevance of the OSI 7 Layer model to computer forensics, Anti forensics.

TEXT BOOKS:

1. Cyber Security by Nina Godbole & sunit Belapure
2. Computer Forensics by Marie- Helen Maras

REFRENCES:

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

1. Paul van Oorschot, Computer Security and the Internet: Tools and Jewels (2020, Springer)
2. Bruce Schneier. Secrets and Lies: Digital Security in a Networked World (2000, Wiley)

Course Outcome

CO1: Follow a structured model in Security Systems Development Life Cycle (SDLC)

CO2: Detect attack methodology and combat hackers from intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources

CO3: Protect data and respond to threats that occur over the Internet

CO4: Design and implement risk analysis, security policies, and damage assessment

CO5: Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment

CO6: Provide contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security

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MCA 303– CYBER SECURITY																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Follow a structured model in Security Systems Development Life Cycle (SDLC)	3	3	2	3	3	3	3	3	3	2	3	2	3	3	2	3	3	3	3	3
CO2: Detect attack methodology and combat hackers from intrusion or other suspicious attempts at connection to gain unauthorized access to a computer and its resources	3	3	2	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO3: Protect data and respond to threats that occur over the Internet	3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO4: Design and implement risk analysis, security policies, and damage assessment	3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO5: Plan, implement and audit operating systems' security in a networked, multi-platform and cross platform environment	3	3	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO6: Provide contingency operations that include administrative planning process for incident response, disaster recovery, and business continuity planning within information security	3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3

SUBHAS UNIVERSITY JAMSHEDPUR

MCA 304– PYTHON PROGRAMMING

UNIT- I

Overview of Programming: Structure of a Python Program, Python Interpreter, Using Python as calculator, Python shell, Indentation. Atoms, Identifiers and keywords, Literals, Strings, Operators(Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator).

UNIT- II

Creating Python Programs : Input and Output Statements, Control statements(Branching, Looping, Conditional Statement, Exit function, Difference between break, continue), Defining Functions, default arguments, Errors and Exceptions.

UNIT- III

Iteration and Recursion: Conditional execution, Alternative execution, Nested conditionals, The return statement, Recursion, Stack diagrams for recursive functions, Multiple assignment, The while statement, Implementing 2-D matrices.

UNIT- IV

Strings and Lists: String as a compound data type, Length, Traversal and the for loop, String slices, String comparison, Looping and counting, List values, Accessing elements, List length, List membership, Lists and for loops, List operations, List deletion. Cloning lists, Nested lists .

UNIT- V

Object Oriented Programming: Introduction to Classes, Objects and Methods, Standard Libraries. Overview of stacks and queues. Overview of packages: networkx, matplotlib.pyplot, numpy.

TEXT BOOKS:

1. Introduction to computation and programming python, by John Guttag, MIT Press.
2. Learning Python, Lutz and Ascher, O'Reilly publications

REFERENCES:

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011

Course Outcome

CO1: Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python

CO2: Express different Decision Making statements and Functions

CO3: Interpret Object oriented programming in Python

CO4: Understand and summarize different File handling operations

CO5: Explain how to design GUI Applications in Python and evaluate different database operations

CO6: Design and develop Client Server network applications using Python

MCA 304– PYTHON PROGRAMMING																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python	3	3	3	2	2	3	3	2	3	2	3	3	3	2	3	2	3	3	3	2
CO2: Express different Decision Making statements and Functions	3	3	3	2	2	3	3	2	3	2	3	3	3	3	3	2	3	3	3	2
CO3: Interpret Object oriented programming in Python	3	3	3	3	2	3	3	2	3	2	3	3	3	3	3	2	3	3	3	2
CO4: Understand and summarize different File handling operations	3	3	3	3	3	3	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO5: Explain how to design GUI Applications in Python and evaluate different database operations	3	3	3	3	3	2	3	2	3	2	3	3	3	3	3	2	3	3	3	3
CO6: Design and develop Client Server network applications using Python	3	3	3	3	2	3	3	2	3	2	3	3	3	3	3	2	3	3	3	2

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 305– COMPUTER GRAPHICS

UNIT-I

Computer Graphics: Picture analysis, Overview of programmer's model of interactive graphics, Fundamental problems in geometry. Scan Conversion: point, line, circle, ellipse polygon, Aliasing, and introduction to Anti Aliasing (No antialiasing algorithm).

UNIT-II

2D & 3D Co-ordinate system: Homogeneous Co-ordinates, Translation, Rotation, Scaling, Reflection, Inverse transformation, Composite transformation. Polygon Representation, Flood Filling, Boundary filling. Point Clipping, Cohen-Sutherland Line Clipping Algorithm, Polygon Clipping algorithms.

UNIT-III

Hidden Lines & Surfaces: Image and Object space, Depth Buffer Methods, Hidden Facets removal, Scan line algorithm, Area based algorithms. Curves and Splines & Rendering: Parametric and Non parametric Representations, Bezier curve, B Spline, Basic illumination model, diffuse reflection, specular reflection, shading, Ground shading, ray tracing, color models like RGB, YIQ, CMY, HSV.

UNIT-IV

Multimedia: Multimedia components, Multimedia Input/output Technologies: Storage and retrieval technologies, Architectural considerations, file formats.

UNIT-V

Animation: Introduction, Rules, problems and Animation techniques

TEXT BOOKS:

2. Multimedia Systems Design, Prabhat Andleigh and Thakkar, PHI.
3. Multimedia Information Networking, N.K.Sharda, PHI

REFERENCES:

1. J. Foley, A. Van Dam, S. Feiner, J. Hughes: Computer Graphics- Principles and Practice, Pearson
2. Hearn and Baker: Computer Graphics, PHI

Course Outcome

CO1: Students will be able to describe the fundamental algorithms used in computer graphics and to some extent be able to compare and evaluate them

CO2: Students will be able to work and interact, through hands-on experiences, to design, develop, and modify electronically generated imaginary using a wide range of sophisticated graphical tools and techniques.

CO3: Students will be able to summarize different hidden surface elimination algorithms and shading techniques used in computer graphics and digital media production.

CO4: Students will be able to explain about the technology necessary for creating multimedia content for the web, video, DVD, 2D and 3D graphics, Sound and programming.

CO5: Students can apply the knowledge, techniques, skills and modern tools to become successful professionals in communication and media industries

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NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 305– COMPUTER GRAPHICS																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Students will be able to describe the fundamental algorithms used in computer graphics and to some extent be able to compare and evaluate them	3	3	2	2	1	2	3	1	2	2	3	3	3	2	2	2	3	1	2	2
CO2: Students will be able to work and interact, through hands-on experiences, to design, develop, and modify electronically generated imaginary using a wide range of sophisticated graphical tools and techniques.	3	3	2	2	1	2	3	2	3	2	3	3	3	2	3	2	3	2	3	2
CO3: Students will be able to summarize different hidden surface elimination algorithms and shading techniques used in computer graphics and digital media production.	3	3	2	2	1	3	3	2	3	3	3	3	3	3	3	2	3	3	3	2
CO4: Students will be able to explain about the technology necessary for creating multimedia content for the web, video, DVD, 2D and 3D graphics, Sound and programming.	3	3	2	3	1	3	3	2	3	3	3	3	3	3	3	2	3	3	3	2
CO5: Students can apply the knowledge, techniques, skills and modern tools to become successful professionals in communication and media industries	3	3	2	3	1	3	3	2	3	3	3	3	3	3	3	2	3	3	3	2

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 306– DATA MINING AND WAREHOUSING (Elective-1)

UNIT-I

Data Mining – Motivation, Importance of DM Functionalities, Basic Data Mining Tasks, DM Applications, and Social Implications

UNIT- II

Differences between Operational Database and Data Warehouse – Multi-dimensional Data Model - From Tables to Data Cubes. Schemas, Measures, DW Implementation – Efficient Computation of Data Cubes.

UNIT-III

Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept of Hierarchy Generation, Task relevant Data, Background Knowledge, Presentation and Visualization of Discovered Patterns.

UNIT- IV

Association Rule Mining, Classification and Prediction – Decision Tree, Baysian Classification Back Propagation, Cluster Analysis, Outlier Analysis.

UNIT-V

Web Content Mining, Web Structure Mining, Web Usages Mining, Spatial Mining, Generalization and specialization, Spatial Rules, Spatial Classification and Clustering Algorithms, Temporal Mining, Modeling Temporal Events, Times Series, Pattern Detection, Sequences.

TEXT BOOKS:

1. Margaret H. Dunham, "Data Mining : Introduction and Advance Topics", Pearson Education, First Indian Reprint, 2003
2. Arun K. Pujari, "Data Mining Techniques", University Press (India) Limited, First edition, 2001

REFERENCES:

1. Efrem O, Mallach, "Decision Support and Data Warehousing Systems", Mcgraw-Hill International Edition, 2000

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Course Outcome

CO1: Learn fetch the data easily from large value of data

CO2: Understand the tools and technique of data mining

CO3: Able to apply data mining techniques in various application and its case studies

CO4: Know the architecture of data ware house and its application

CO5: Understand the concept of Online analytical processing (OLAP) and its implementation.

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MCA 306– DATA MINING AND WAREHOUSING (Elective-1)																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Learn fetch the data easily from large value of data	3	2	3	3	2	2	2	3	3	2	3	2	2	3	2	3	2	3	3	3
CO2: Understand the tools and technique of data mining	3	3	2	3	2	2	2	3	3	2	3	3	2	3	2	3	2	3	3	3
CO3: Able to apply data mining techniques in various application and its case studies	2	2	2	2	3	2	2	3	2	3	3	2	2	3	2	3	3	3	2	3
CO4: Know the architecture of data ware house and its application	3	3	3	3	3	3	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO5: Understand the concept of Online analytical processing (OLAP) and its implementation	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 306– SEARCH ENGINE OPTIMIZATION (Elective-2)

UNIT – I

Basics for SEO: What is Domain, Basic Knowledge of World Wide Web, Difference between Portal and Search Engines, What are SEO, Types of SEO Techniques, Black hat techniques, White Hat techniques, and How Search Engine works?

UNIT - II

SEO Research & Analysis: Market Research, Keyword Research and Analysis, Keyword opportunity, Competitors Website Analysis, SWOT Analysis of Website, How to Choose Best Keywords, Tools available for Keyword Research.
Website Design SEO Guidelines: Content Research, Content Guidelines, Content Optimization, Design & Layout, XML Sitemap / URL List Sitemap.

UNIT- III

On-page Optimization: The Page Title, Meta Descriptions & Meta Keywords, Headings, Bold Text, Domain Names & Suggestions, Canonical Tag, Meta Tags, Images and Alt Text, Internal Link Building, The Sitemap, Invisible Text, Server and Hosting Check, Robots Meta Tag, Doorway Pages, 301 Redirects, 404 Error, Duplicate content.

UNIT – IV

Off-page Optimization: Page Rank, Link Popularity, Link Building in Detail, Directory Submission, Social Bookmark Submission, Blog Submission, Articles, Links Exchange, Reciprocal Linking, Posting to Forums, Submission to Search Engine, RSS Feeds Submissions, Press Release Submissions, Forum Link Building, Competitor Link Analysis.

UNIT-V

Analytics: Google Analytics, Installing Google Analytics, How to Study Google Analytics, Interpreting Bars & Figures, How Google Analytics can Help SEO, Advanced Reporting, Webmaster Central & Bing/Yahoo, Open Site Explorer, Website Analysis using various SEO Tools available. SEO Tools: Keyword Density Analyzer Tools, Google Tools, Yahoo / Bing Tools, Rich Snippet Text Tools, Comparison Tools, Link Popularity Tools, Search Engines Tools, Site Tools, Miscellaneous Tools.

SEO Reporting: Google analysis, Tracking and Reporting, Reports Submission, Securing Ranks

TEXT BOOKS:

1. The Art of SEO (Theory in Practice) - Eric Enge, Stephen Spencer, Jessie Stricchiola, and Rand Fishkin (O'REILLY)
2. Search Engine Optimization All-in-One For Dummies by Bruce Clay

REFERENCES:

1. SEO Step-by-Step by Caimin Jones

Course Outcome

CO1: Define search engine marketing.
CO2: Identify elements of search engine marketing plan.
CO3: Develop Web pages designed to be easily crawled and optimally indexed by search engines.
CO4: Construct search engine-friendly Web sites.
CO5: Create Pay-Per-Click (PPC) Campaigns.
CO6: Apply Google Analytics and other metrics and tools to monitor progress in achieving search engine marketing goals.

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MCA 306– SEARCH ENGINE OPTIMIZATION (Elective-2)																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Define search engine marketing.	3	3	2	3	3	3	3	3	3	2	3	2	3	3	2	3	3	3	3	3
CO2: Identify elements of search engine marketing plan.	3	3	2	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO3: Develop Web pages designed to be easily crawled and optimally indexed by search engines.	3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO4: Construct search engine-friendly Web sites.	3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO5: Create Pay-Per-Click (PPC) Campaigns.	3	3	3	3	3	3	3	3	3	2	3	3	3	3	2	3	3	3	3	3
CO6: Apply Google Analytics and other metrics and tools to monitor progress in achieving search engine marketing goals.	3	3	3	3	3	2	3	3	3	2	3	3	3	3	2	3	3	3	3	3

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SEMESTER-IV

MCA Year 2 - Semester IV								
Theory								
S. No.	**Course Code**	**Course Title**	**Hours**		**Marks**			**Credits**
			L	**P**	**IA**	**ETE**	**Total**	
1	MCA-401	Software Quality Assurance & Engineering	3	0	30	70	100	3
2	MCA-402	Elective 2	3	0	30	70	100	3
Practical								
3	MCA-451	Industrial Project	0	12	30	70	100	06
Total					**90**	**210**	**300**	**12**

L= Lecture, **P** = Practical, **IA** = Internal Assessment, **ETE** = End Term Exam

Note: The industrial project is part of the curriculum will be held in the institute as one of the laboratories. This may be in continuations to the project under taken by the student during industrial training and/or of industrial nature and/or have good industrial significance and/or may be done in collaboration with industry (as per suitability at the institute level). The evaluation will be done in the institute by one internal examiner and one external examiner (from outside the institute) appointed by University.

Elective 2:

a) Artificial Intelligence
b) Network Security and Cryptography

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 401- SOFTWARE QUALITY ASSURANCE AND ENGINEERING

UNIT- I

SOFTWARE QUALITY AND ENGINEERING: Quality concepts and productivity relationship, software quality factors, software quality costs, Total Quality Management (TQM), continuous improvement cycle: Plan, Do, Check and Act (PDCA), quality policy, cost of quality, quality engineering, quality planning: goal setting and strategy formation, assessment and improvement.

UNIT- II

SOFTWARE QUALITY ASSURANCE (SQA): Components of SQA, classification, defect detection, defect prevention, defect reduction, defect containment, QA activities in software processes, verification and validation, software review, inspection, formal verification, statistical software quality approach.

UNIT- III

COMPONENTS MEASUREMENT WITH REFERENCE TO SQA: Metrics, product quality metrics, process quality metrics, metrics for software maintenance, quality tools for quality control, test management and organizational structures, Capability Maturity Model (CMM), Capability Maturity Model Integration (CMMI), ISO 9000, quality and quality management metrics, Deming"s Principle, SQA team formation

UNIT- IV

QUALITY MANAGEMENT MODEL: Integrating quality activities in project life cycle, reviews, software testing, strategies and implementation, Computer-Aided Software Engineering (CASE) tools, The Rayleigh model framework, code integration pattern, Problem Tracking Report (PTR), reliability growth model, Service Quality, Kano Model, Customer retention, continuous process improvement, Juran"s Trilogy, TQM principles, Kaizen Technique, Statistical Quality Assurance, Mc call quality factors

UNIT –V

SOFTWARE QUALITY ASSURANCE BEYOND TESTING: Defect prevention and process improvement, root cause analysis for defect prevention, software inspection, inspection related activities, fault tolerance and failure containment, comparing quality assurance techniques and activities.

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TEXT BOOKS:

1. An Integrated Approach to Software Engineering, Pankej Jalote, Narosa Publishing House, New Delhi 1997.

REFERENCES:

1. Metrics and Models in Software Quality Engineering, Stephan H. Kan, Pearson Education, 2007.
2. Making Sense of Software Quality Assurance, Raghav J. Nandyal, Tata McGRAW Hill, 2007.

Course Outcome

CO1: Design and implement Test Plans and Procedures

- Students can design comprehensive test plans
- Students can create test procedures
- Students can evaluate the results of tests
- Students can assess a software process to evaluate how effective it is at promoting quality

CO2: Apply a wide variety of testing techniques at various testing levels

- Students differentiate the purposes and applicable techniques among the various levels of testing: unit, integration, system, acceptance, usability, and regression testing
- Students can conduct effective and efficient inspections
- Students can explain and apply graph coverage criteria for structural coverage
- Students can explain and apply data flow coverage and logic coverage
- Students can explain and apply input space partitioning
- Students can explain and apply mutation testing

CO3: Use test tools to effectively test software

- Students can use Junit

CO4: Compute and use various testing metrics

- Students can compute test coverage and yield, according to a variety of criteria
- Students can use statistical techniques to evaluate the defect density and the likelihood of fault

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MCA 401- SOFTWARE QUALITY ASSURANCE AND ENGINEERING																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Design and implement Test Plans and Procedures	3	3	2	2	1	2	3	2	3	3	3	3	3	2	3	2	3	1	3	3
CO2: Apply a wide variety of testing techniques at various testing levels	3	3	2	3	2	2	3	2	3	3	3	3	3	3	3	2	3	1	3	3
CO3: Use test tools to effectively test software	3	3	2	2	1	2	3	2	3	2	3	3	3	2	3	2	3	2	3	2
CO4: Compute and use various testing metrics	3	3	3	3	2	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 402- ARTIFICIAL INTELLIGENCE (Elective-2)

UNIT- I

AI History and Applications: Defining AI: Acting Humanly (Turing Test Approach), Thinking Humanly (Cognitive Modeling Approach), Thinking Rationally (laws of thought approach), Acting Rationally (Rational Agent Approach); Foundations of Artificial Intelligence; History of AI, AI techniques, Expert Systems.

UNIT –II

Problem Solving by Search: Defining the problem as a State Space Search Strategies: Breadth – first Search, Depth- first search, Depth limited search, Iterative Depending depth first search. Heuristic Search Techniques: Hill Climbing, Simulated Annealing, Best First Search: OR Graphs, Heuristic Functions, A* Algorithm, AND –OR graphs, AO* Algorithm.

UNIT- III

Knowledge Representation: Representations and mappings, Approaches to knowledge Representation, Procedural versus Declarative knowledge; Predictive Logic: Representing Simple facts, Instance and Isa relationships in Logic, Proposition versus Predicate Logic, Computable Functions and Predicates- not, Rules of Inferences and Resolution-not, Forward versus Backward Reasoning, Logic Programming and Horn Clauses. Weak slot and Filler Structure: Semantic Nets, Frames. Strong slot Filler Structures: Conceptual Dependency, scripts.

UNIT –IV

AI Programming Languages (PROLOG): Introduction, How Prolog works, Backtracking, CUT and FAIL operators, Built –in Goals, Lists, Search in Prolog.

UNIT- V

Connectionist Models / ANN: Foundations for Connectionist Networks, Biological Inspiration; Different Architectures and output functions: Feed forward, Feedback, Recurrent Networks, step, Sigmoid and different functions.

TEXT BOOKS:

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

1. Stuart Russel and Peter Norvig: Artificial Intelligence – A Modern Approach, 2nd Edition Pearson Education
2. N.P. padhy: Artificial Intelligence and Intelligent Systems, Oxford Higher Education, Oxford University Press

REFERENCES:

1. George F Luger: Artificial Intelligence- Structures and Strategies for complex Problem Solving, 4th Ed. Pearson Education
2. Ivan Bratko: PROLOG Programming 2nd Ed., Pearson Education

COURSE OUTCOMES:

CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.

CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

CO4: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.

CO5: Demonstrate proficiency in applying scientific method to models of machine learning.

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 402- ARTIFICIAL INTELLIGENCE (Elective-2)																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	3	3	2	2	1	2	3	2	3	3	3	3	3	2	3	2	3	1	3	3
CO2: Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	3	3	2	3	2	2	3	2	3	3	3	3	3	3	3	2	3	1	3	3
CO3: Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	3	3	2	3	2	2	3	2	3	3	3	3	3	3	3	2	3	1	3	3
CO4: Demonstrate proficiency developing applications in an 'AI language', expert system shell, or data mining tool.	3	3	2	2	2	2	3	2	3	2	3	2	3	2	3	2	3	1	3	3
CO5: Demonstrate proficiency in applying scientific method to models of machine learning.	3	3	3	3	2	3	3	2	3	3	3	3	3	2	3	3	3	2	3	3

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 402- NETWORK SECURITY & CRYPTOGRAPHY (Elective-2)

UNIT-I

Basics of Cryptography: Terminologies used in Cryptography; Substitution Techniques – The Caesar Cipher, One-Time Pads, The Vernam Cipher, Book Cipher; Transposition Techniques –Encipherment /Decipherment Complexity, Diagrams, Trigrams, and Other Patterns.

UNIT-II

Encryption and Decryption: Characteristics of Good Encryption Technique; Properties of Trustworthy Encryption Systems; Types of Encryption Systems – Based on Key, Based on Block; Confusion and Diffusion; Cryptanalysis.

UNIT-III

Symmetric Key Encryption: Data Encryption Standard (DES) Algorithm – Overview of the DES Algorithm; Double and Triple DES – Double DES, Triple DES; Security of the DES; Advanced Encryption Standard (AES) Algorithm – Overview of Rijndael, Strength of the Algorithm; DES and AES Comparison.

UNIT-IV

Public Key Encryption: Characteristics of Public Key System; RSA Technique – Encryption-Method; Key Exchange; Diffie-Hellman Scheme; Cryptographic Hash Functions; Digital Signature – Properties of Digital Signature, Public Key Protocol; Certificates; Certificate Authorities.

Network Security: Network Concepts; Threats in Networks – Who Attacks Networks? Threats in Transit: Eavesdropping and Wiretapping, Protocol Flaws, Impersonation; Network Security Controls – Architecture, Encryption, Virtual Private Networks, Public Key Infrastructure (PKI) and Certificates.

UNIT-V

Web Security: Web Security Requirements; Secure Socket Layer (SSL) – SSL Architecture, SSL Protocol; Transport Layer Security (TLS); Secure Electronic Transaction (SET) – Features, Components, Dual Signature, Purchase Request.

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TEXT BOOKS:

1. William Stallings, Cryptography and Network Security, 6 th Edition, Pearson Education, March 2013.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata Mc Graw Hill,2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications,2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India,2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia,2000.

Course Outcomes

CO1: Analyze and design classical encryption techniques and block ciphers.

CO2: Understand and analyze data encryption standard.

CO3: Understand and analyze public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc.

CO4: Understand key management and distribution schemes and design User Authentication Protocols.

CO5: Analyze and design hash and MAC algorithms, and digital signatures.

CO6: Design network application security schemes, such as PGP, S/ MIME, IPSec, SSL, TLS, HTTPS, SSH, etc.

CO7: Know about Intruders and Intruder Detection mechanisms, Types of Malicious software, Firewall Characteristics, Types of Firewalls, Firewall Location and Configurations.

NETAJI SUBHAS UNIVERSITY JAMSHEDPUR

MCA 402- NETWORK SECURITY & CRYPTOGRAPHY (Elective-2)																				
COs \ POs / PSOs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	**PSO6**	**PSO7**	**PSO8**	**PSO9**	**PSO10**
CO1: Analyze and design classical encryption techniques and block ciphers.	3	3	2	3	1	3	3	2	3	2	3	2	3	3	3	3	3	1	3	2
CO2: Understand and analyze data encryption standard.	3	3	2	3	1	3	3	2	3	2	3	2	3	3	3	3	3	1	3	2
CO3: Understand and analyze public-key cryptography, RSA and other public-key cryptosystems such as Diffie-Hellman Key Exchange, ElGamal Cryptosystem, etc.	3	3	2	3	2	3	3	2	3	3	3	2	3	3	3	3	3	2	3	3
CO4: Understand key management and distribution schemes and design User Authentication Protocols.	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3
CO5: Analyze and design hash and MAC algorithms, and digital signatures.	3	3	2	3	2	3	3	2	3	3	3	3	3	3	3	3	3	1	3	3
CO6: Design network application security schemes, such as PGP, S/ MIME, IPSec, SSL, TLS, HTTPS, SSH, etc.	3	3	2	3	2	3	3	2	3	3	3	2	3	3	3	3	3	2	3	3
CO7: Know about Intruders and Intruder Detection mechanisms, Types of Malicious software, Firewall Characteristics, Types of Firewalls, Firewall Location and Configurations.	3	3	3	3	1	3	3	3	3	3	3	3	3	3	3	3	3	1	3	3

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