SYLLABUS

Choice Based Credit System (CBCS)

Department of Computer Application

Master of Computer Application (MCA)

Four Semesters Program

2023-25

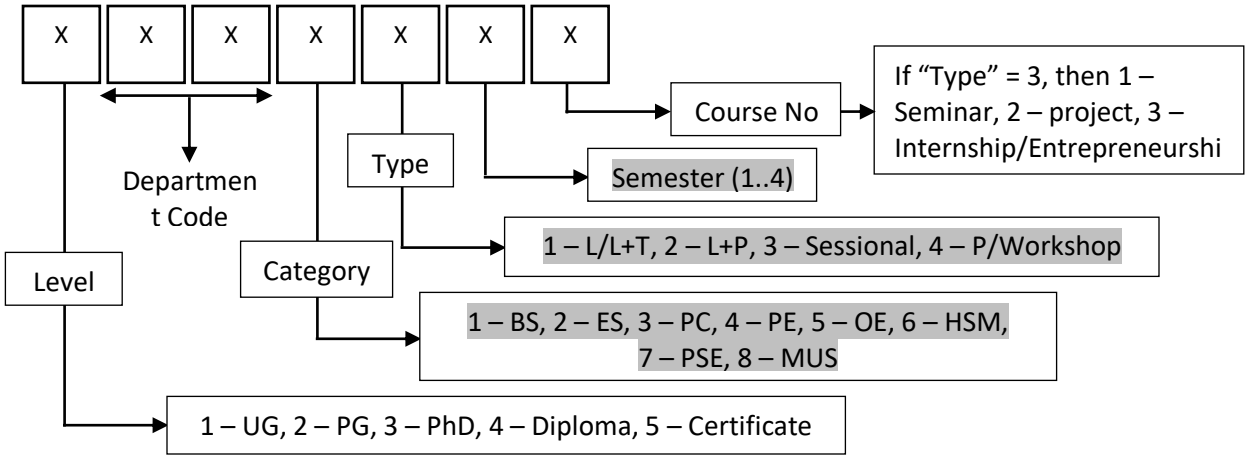
Credit Definition

Type	Duration (in Hour)	Credit
Lecture (L)	1	1
Tutorial (T)	1	1
Practical (P)	2	1

Category Codification with Credit Break up

Definition of Category	Code	No	Credit
Basic Science	BS	1	05
Engineering Science	ES	2	00
Professional Core	PC	3	42
Professional Elective (Discipline Specific)	PE	4	02
Open Elective (General Elective)	OE	5	02
Humanities & Social Science including Management	HSM	6	09
Project Work / Seminar / Internship / Entrepreneurship	PSE	7	22
Mandatory / University Specified (Environmental Sc. / Induction Training / Indian Constitution / Foreign language)	MUS	8	08
Total			**90**

Subject Codification Nomenclature



SEMESTER: I

Mandatory Induction Program – Duration 3 weeks

- Physical Activity
- Creative Arts
- Universal Human Values
- Literary
- Proficiency Modules
- Lectures by Eminent People
- Visits to Local Areas
- Familiarization to Department/Branch & Innovations

Category	Paper Code	Paper Name	Contact Hours/Week			
			L	T	P	Credit
Theory						
PC	2203211	Computer Architecture & Organization	3	0	0	3
PC	2203212	Data Structure and Algorithms	3	0	0	3
PC	2203213	Data Base Management Systems	3	0	0	3
BS	2191113	Discrete Mathematics	3	0	0	3
HSM	2206114	Communicative English	3	0	0	3
MUS	1278111/ 1278112/ 1278113	Foreign Language – I (German /Spanish /Japanese/Italian)	2	0	0	2
Practical						
PC	2203221	Computer Architecture & Organization Lab	0	0	2	2
PC	2203222	Programming & Data Structure Lab	0	0	2	2
PC	2203223	Database Management Systems Lab	0	0	2	2
			Total Hours = 25			23

Semester II

Category	Paper Code	Paper Name	Contact Hours/Week			
			L	T	P	Credit
Theory						
PC	2203221	Software Engineering using UML	3	0	0	3
PC	2203222	Computer Networks	3	0	0	3
PC	2203223	Python Programming	3	0	0	3
PC	2203224	Operating Systems	4	0	0	4
HSM	2206125	Management Information System	3	0	0	3
MUS	1278111/ 1278112/ 1278113	Foreign Language – II (German /Spanish /Japanese/Italian)	2	0	0	2
Practical						
PC	2203231	Software Engineering using UML Lab	0	0	2	2
PC	2203233	Python Programming Lab	0	0	2	2
PC	2203234	Operating Systems Lab	0	0	2	2
			Total Hours = 24			24

Semester III

Category	Paper Code	Paper Name	Contact Hours/Week			
			L	T	P	Credit
Theory						
PC	2203231	Artificial Intelligence	3	0	0	3
PC	2203232	Theory of Computation	3	0	0	3
PE	2204123	Elective	2	0	0	2
BS	2191135	Operation Research	2	0	0	2
HSM	2203234	Accounting and Management Control	2	1	0	3
MUS	1278131/ 1278132/ 1278133	Foreign Language – III (German /Spanish /Japanese/Italian)	2	0	0	2
PSE	2207436	Minor Project-I	0	0	0	6
Practical						
PC	2203241	Artificial Intelligence Lab	0	0	2	2
			Total Hours = 17			23

Semester IV

Category	Paper Code	Paper Name	Contact Hours/Week			
			L	T	P	Credit
PSE	2207441	Major Project (6 months)	0	0	0	12
PSE	2207342	Grand Viva	0	0	0	6
MUS	1278131/ 1278132/ 1278133	Foreign Language – IV (German /Spanish /Japanese/Italian)	2	0	0	2
			Total Hours = 2			20
Total Credits = 90						

Elective (2204123)

A. Data Mining & Warehousing
B. Compiler Design
C. Distributed Database System
D. AI & Neural Network
E. Cryptography and Network Security
F. Machine Learning
G. Internet of Things
H. Cloud Computing

Program Outcome:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural and engineering sciences.

PO3. Design/Development of solutions: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety and the cultural societal and environmental considerations.

PO4. Conduct investigations of complex problems: Use research based knowledge including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.

PO5. Modern tool usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to access societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9. Individual and team work: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.
PO10. Communications: Communicate effectively with the engineering community and with the society at large. Be able to comprehend and write effective reports documentation. Make effective presentations and give and receive clear instructions.
PO11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.
PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

SEMESTER I

PAPER NAME: Computer Organization and Architecture

Paper Code: 2203211

Module-1 (6L)	Principles of Computer design - Software, hardware interaction layers in computer architecture, Central processing unit.
Module-2 (6L)	Machine language instructions, Addressing modes, instruction types, Instruction set selection, Instruction cycle and execution cycle.
Module-3 (8L)	Control unit, Data path and control path design, Microprogramming Vs hardware control, RISC Vs. CISC, Pipelining in CPU design: Superscalar processors.
Module-4 (8L)	Memory system, Storage technologies, Memory array organization, Memory hierarchy, interleaving, cache and virtual memories and architectural aids to implement these.
Module-5 (4L)	Input-output devices and characteristics, Input-output processing, bus interface, data transfer techniques, I/O interrupts, channels.
Module-6 (4L)	Performance evaluation - SPEC marks, Transaction Processing benchmarks

References:

1. Mano, M, "Computer System and Architecture", (3rd edition) Prentice Hall of India, New Delhi, 1994.
2. Pal Chauduri, P., "Computer Organization and Design", Prentice Hall of India, New Delhi, 1994.
3. Rajaraman,V., and Radhakrishnan, T., "Introduction to Digital Computer Design" (4th edition). Prentice Hall of India, New Delhi, 1997.
4. Stallings. W, "Computer Organization and Architecture, (2nd edition) Prentice Hall of India, New Delhi

Course Objectives:

- Illustrate the structure, function and characteristics of computer systems.
- Exhibit the design of the various functional units of digital computers.
- Discuss different types of memories and their properties.
- Introduce basics of Parallel Computer Architecture.

Course Outcomes:

CO#	Course Outcomes
CO1	Discuss the working of functional components of the computer
CO2	Demonstrate instruction execution cycle
CO3	Categories various memory types according to their properties
CO4	Describe the principles of memory management
CO5	Explain how interrupts are used to implement I/O control and data transfers
CO6	Examine various inter connection structures of multi processors

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	2	3	2	1	3	1	3
CO2	2	1	3	1	2	1	2	1	2	2	1	1
CO3	2	2	1	2	2	2	1	3	2	2	2	1
CO4	2	1	2	1	1	3	2	1	1	1	2	2
CO5	3	2	2	2	3	2	1	2	1	2	3	1
CO6	2	3	3	3	2	1	2	3	2	1	2	3

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Data Structures and Algorithms
Paper Code: 2203212

Module-1 (8L)	Introduction to algorithms, Flow charts, tracing flow charts, Problem-solving methods, need for computer languages, reading programs written in C language, C character set, Identifiers and keywords, Data types, Declarations, Expressions, statements and symbolic constants, Input-Output: getchar, putchar, scanf, printf, gets, puts, functions, Pre-processor command: # include, define, ifdef. Preparing and running a complete C program.
Module-2 (8L)	Operators and expressions: Arithmetic, unary, logical, bit-wise, assignment and conditional operators, Library functions, Control statements: while, do-while, for statements, nested loops. If-else, switch, break, continue and goto statements, comma operator.
Module-3 (8L)	Functions: Defining and accessing: passing arguments, Function prototypes, Recursion, Use of library functions, Storage classes: automatic, external, and static variables, Arrays: Defining and processing, Passing to a function, Multi-dimensional arrays.
Module-4 (6L)	Strings, operations on strings. Pointers: Declarations. Passing to a function, Operations on pointers, Pointers and arrays, Arrays of pointers.
Module-5(4L)	Structures: Defining and processing, Passing to a function, Unions. Data files: Open, close, create, process. Unformatted data files.
Module-6 (2L)	Data Structures: Stacks, queues, lists, trees, and their application

References:

1. Hutchison, R., "Programming in C". McGraw Hill, New York, 1990.
2. Johnsonbaugh, R., and Kalin, M., "Applications Programming in C", Prentice Hall of India, 1989. Rajaraman, V, "Computer Programming in C", Prentice Hall of India, New Delhi, 1995.

Course Objectives:

- To understand algorithms and its analysis procedure.
- To design and implement various data structure algorithms.
- To introduce various techniques for representation of different types of data in the real world.
- Compute the complexities of various algorithms.

Course Outcomes:

CO#	Course Outcomes
CO1	Select appropriate data structures as applied to the specified problem definition.
CO2	Implement operations like searching, insertion, deletion, traversing mechanism, etc. on various data structures.
CO3	Compare Linear and Non-Linear data structures.
CO4	Apply appropriate sorting/searching techniques for the given problems.
CO5	Design advanced data structure using Non-Linear data structure.
CO6	Determine and analyze the complexity of given Algorithms

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	2	3
CO2	2	3	3	2	1	2	2	1	1	2	1	3
CO3	2	1	2	1	1	1	2	3	2	1	2	1
CO4	2	2	3	2	1	2	1	3	3	2	1	2
CO5	3	2	3	2	3	1	2	2	2	2	3	2
CO6	2	1	3	3	2	2	2	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Database Management Systems

Paper Code: 2203213

Module-1(4L):	Introduction to Databases and Transactions: What is a database system, purpose of the database system, view of data, relational databases, database architecture, and transaction management.
Module-2(4L)	Data Models: The importance of data models, Basic building blocks, Business rules, The evolution of data models, Degrees of data abstraction.
Module-3(8L)	Database Design, ER-Diagram and Unified Modeling Language Database design and ER Model: Overview, ER-Model, Constraints, ER-Diagrams, ERD Issues, weak entity sets, Codd's rules, Relational Schemas, Introduction to UML Relational database model: Logical view of data, keys, integrity rules. Relational Database

	design: features of good relational database design, atomic domain and Normalization (1NF, 2NF, 3NF, BCNF).
Module-4(8L)	Relational Algebra and Calculus Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison. Calculus: Tuple relational calculus, Domain relational Calculus, calculus vs algebra, computational capabilities.
Module-5(6L)	Constraints, Views and SQL What is constraints, types of constrains, Integrity constraints, Views: Introduction to views, data independence, security, updates on views, comparison between tables and views SQL: data definition, aggregate function, Null Values, nested sub queries, Joined relations. Triggers.
Module-6(6L)	Transaction management and Concurrency Control Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management.

References:

1. A Silberschatz, H Korth, S Sudarshan, “Database System and Concepts”, fifth Edition McGrawHill.
2. Rob, Coronel, “Database Systems”, Seventh Edition, C Language Learning.

Course Objectives:

- Explain the purpose for developing a data warehouse.
- Describe and use the dimensional modeling techniques.
- Use OLAP analysis with contemporary analysis and visualization tools.
- Understand the purpose of data mining and knowledge discovery process.
- Understand several different data mining techniques such as market basket analysis, Clustering, classification.

Course Outcomes:

CO#	Course Outcomes
CO1	Explain DBMS architecture, physical and logical database designs, database modelling, relational, hierarchical and network models
CO2	Identify basic database storage structures and access techniques such as file organizations, indexing methods including B-tree, and hashing
CO3	Learn and apply Structured Query Language (SQL) for database definition and database manipulation
CO4	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database
CO5	Understand various transaction processing, concurrency control mechanisms and

	database protection mechanisms
CO6	Improve the database design by applying normalization techniques

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	2	3	1	1	2	2	1	1	2	1	3
CO3	3	1	2	2	2	1	2	3	2	2	2	1
CO4	2	2	1	1	2	2	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Discrete Mathematics

Paper Code: 2191113

Module-1 (8L)	Introduction to Mathematical Logic: Notation. Predicate Logic, Introduction to mathematical theorems and proofs, proof by contraposition and contradiction.
Module-2 (8L)	Algebraic Structures: Set, Groups, Ring, Field. Binary and Unary operation on a Set , Algebraic operation on Set, Cartesian Product, Binary
Module-3(6L)	Graph theory: Definition. Paths, reachability, connectedness. Matrix representation of graphs, Trees.
Module-4 (6L)	Storage representation and manipulation of graphs: Trees.
Module-5 (4L)	List structures and graphs, Pert, and related techniques.
Module-6 (4L)	Introduction to Logic Circuits: Karnaugh Maps (Boolean expressions using Karnaugh map or Boolean algebra properties), Basic Logic Gates, Representation of Boolean Expression as a Combinational network and vice versa.

References

1. Kolman, B., and Busby. R., "Discrete Mathematical Structures for Computer Science", Prentice Hall. 1987.
2. Sahni, S., "Concepts in Discrete Mathematics". Camelot Publisher. U.S.A. 1981.
3. Tremblay, J.P., el. al. "Discrete Mathematical Structures with Applications to Computer Science" McGraw Hill, 1987.

Course Objectives:

- Use mathematically correct terminology and notation.
- Construct correct direct and indirect proofs.

- Use division into cases in a proof.
- Use counter examples.
- Apply logical reasoning to solve a variety of problems.

Course Outcomes:

CO#	Course Outcomes
CO1	Perform operations on various discrete structures such as sets, functions, relations, and sequences.
CO2	Ability to solve problems using Counting techniques, Permutation and Combination, Recursion, and generating functions.
CO3	Apply algorithms and use graphs and trees as tools to visualize and simplify Problems.
CO4	Use of K-Maps and Truth Tables to construct and verify the correctness of a Boolean expression.
CO5	Create the various properties of algebraic systems like Rings, Monoids, and Groups.
CO6	Able to model and solve real-world problems using graphs and trees.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	2	3	2	2	2	1	2	3	2	2	2	1
CO4	3	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	3	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Communicative English

Paper Code: 2206114

Module-1 (6L)	Essay and précis writing
Module-2 (6L)	Slide preparation and oral presentation principles
Module-3 (6L)	Written presentation of technical material
Module-4 (6L)	preparation of bibliography, basic of official correspondence
Module-5 (6L)	Preparation of bio-data
Module-6 (6L)	Group discussions should also be used and feedback is given to students

References

1. The Chicago Manual of Style, 13th Edition, Prentice Hall of India, 1989 Gowers, Ernest, "The Complete Words". Penguin, 1973.
2. IEEE Transactions on ''Written and Oral Communications" has many papers of relevance
3. Ludlow, R., and Panton, F., "The Essence of Effective Communication", Prentice Hall of India Pvt. Ltd. 1995.
4. Menzel, D.H., Jones, H.M., Boyd, L.G., ''Writing a Technical Paper". McGraw Hill, 1961.
5. Strunk, W., White. E.B., ''The Elements of Style", 3rd Edition, McMillan, 1979.
6. Munter, M., ''Business Communication: Strategy and Style" Prentice Hall, New Jersey, 1987.
7. Tubian, K.L., "A Manual for Writen of 1erm Papers, Thesis and Dissertation", Univ. of Chicago Press, 1973.

Course Objectives:

- To enhance the level of literary and aesthetic experience of students and to help them respond creatively.
- To sensitize students to the major issues in the society and the world.
- To provide the students with an ability to build and enrich their communication skills.
- To equip students to utilize the digital knowledge resources effectively for their chosen fields of study.
- To help them think and write imaginatively and critically.
- To broaden their outlook and sensibility and acquaint them with cultural diversity and divergence in perspectives.
- Equip them with basic knowledge to pursue careers in publishing, cinema, theatre, journalism, education and advertising.

Course Outcomes:

CO#	Course Outcomes
CO1	To sensitize students to the language, forms and types of poetry, fiction, prose, film and drama
CO2	To sensitize students to the nuances of spoken and written forms of English
CO3	To familiarize students with the concepts of copy-editing and impart to them basic copy-editing skills and familiarize them with the diverse concerns addressed by feminism.
CO4	To update and expand basic informatics skills and attitudes relevant to the emerging knowledge society
CO5	To enable them to produce grammatically and idiomatically correct language and help master writing techniques to meet academic and professional needs.
CO6	To provide sufficient practice in Vocabulary, Grammar, Comprehension, and Remedial English from the perspective of career-oriented tests.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	3	2	2	2	2	1	2	3	2	2	2	1
CO4	2	1	1	1	1	3	1	2	1	2	1	2
CO5	3	2	3	2	3	1	2	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

SEMESTER II

PAPER NAME: SOFTWARE ENGINEERING USING UML

Paper Code: 2203221

Module 1(L6)	Introduction to Software Engineering, Software life cycles - different models
Module 2(L6)	Software Project Management
Module 3(L6)	Structured system design, Cost Estimation-COCOMO, Data-Oriented Analysis, and Design
Module 4(L6)	Object Oriented Analysis & Design, development methodologies- Computer Aided Software Engineering (CASE) tool, Object Oriented modelling.
Module 5 (L6)	Software quality assurance, Software testing techniques and strategies, test planning, reporting and bug fixing, Test automation, regression testing
Module 6 (L6)	Software maintenance, Software Complexity & Reliability, Project using SPM.

References:

1. Software Engineering, Rogers G. Pressman, MH
2. Fundamentals of Software Engineering, Fourth Edition, Rajib Mall, PHI
3. Software Engineering, Pankaj Jalote, PHI
4. Software Engineering, Ian Sommerville, 9th Edition, Pearson Education
2. Fundamentals of Software Engineering, 2nd Ed.,Ghezzi,PHI
4. Classical and Object Oriented Software Engineering, Schach, TMH
5. Software Engineering: Principles & Practice, Van Vliet,SPD/JOHN WILEY

Course Objectives:

- Be successful professionals in the field with solid fundamental knowledge of software engineering
- Utilize and exhibit strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams

- Apply their foundations in software engineering to adapt to readily changing environments using the appropriate theory, principles and processes

Course Outcomes:

CO#	COURSE OUTCOMES
CO1	Demonstrate knowledge of the wider software engineering context, software engineering processes and theirapplicability.
CO2	Understand a problem domain and to elicit, analyze, and specify the requirements of a software system solution.
CO3	Describe and formulate test cases to perform different levels of testing
CO4	Identify and outline specific components of a software design that can be targeted for reuse.
CO5	Use the Agile process to develop a quality software product.
CO6	Analyze the engineering problems encountered in system and software development

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	2	1	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	2	3	2	2	2	1
CO4	3	2	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	2	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Computer Networks

Paper Code: 2203222

Module 1(L6)	Introduction to computer network- Topology; Base Band & Broad Band Topology; Guided & Unguided Media. Overview of Data & Signal Bits. Baud & Bit Rate. Modulation (AM, PM, FM); Multiplexing (TDM, FDM, STDM).
Module 2(L6)	Encoding (RZ, NRZ, BIPLOAR, MANCHESTER, DIFF. MANCHESTER). Digital to Analog – ASK, PSK, FSK, QPSK.
Module 3(L6)	Transmission methods – Synchronous & Asynchronous, Flow Control, Error Control, Error Detection methods. Goals of Layered protocols- Introduction to OSI, TCP/IP, IBM, SNA, ATM. Bit oriented (BSC) & Character oriented Protocol

	(SDLC, LAPB, LAPD, LLC). HDLC- frame format, station, states, configuration, access control.
Module 4(L6)	LAN Topology– Ethernet (IEEE 802.3), Token Bus (IEEE 802.4), Token Ring (IEEE 802.5). Introduction to WAN – DQDB (IEEE 802.6) & FDDI. Module 11(L3): Switching Technologies – Circuit, Message, and Packet. X.25, X.21, RS-232 C – frame format, channel, packet frames, facilities (In brief Only).
Module 5(L6)	ISDN- D channel, B-Channel, International Standards, NT1, NT2, TA, TE Devices. Introduction to leased lines, DSL, Digital Carriers. Bridging & Routing – Static & Dynamic (In Brief).
Module 6(L6)	IP, IP addressing, ICMP, ARP.RARP. Congestion Control, TCP, UDP. HTTP, FTP, Telnet, SMTP. Introduction to data security (private key, public key, ISO standards). Introduction to Mobile technology (Topology, FDM, TDM, CDMA), Satellite Communication (LEO, GEO, TDM).

References:

1. Data Communication & Networking, Forouzan, TMH
2. Computer Networks, Tannenbaum, PHI
3. Data & Computer Communications, Stallings,PHI
4. Data Communications, Prakash C. Gupta, PHI
5. Computer Networking, Tittel, Schaum Outline Series, TMH
6. TCP/IP Network Administration, Hunt, SPD/O'REILLY

Course Objectives:

- Demonstrate knowledge of principles of computer networking
- Understand details and functionality of layered network architecture
- Know Internet applications and their protocols
- Understanding applications (e.g. Client Server applications, Web Services)
- Describe and use of Multimedia Information

Course Outcomes:

CO#	COURSE OUTCOMES
C01	To develop the understanding various IEEE standards for computer networks
CO2	Understanding the Internet protocol in multicasting routing protocols and routing algorithms.
CO3	To learn mechanism for overlay networks and various routing protocols
CO4	To know the multicasting and routing algorithms.
CO5	To acquire the basic network security principle including encryption algorithms

CO6	Examine the issues related to security in computer networks

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	2	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	3	2	1	2	1	2	3	2	1
CO4	2	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Operating Systems
Paper Code: 2203224

Module I(6L)	Introduction-Evolution of operating systems, Types of operating systems, Different views of the operating system, operating system concepts, and structure. Processes: The Process concept, a systems programmer's view of processes. The operating system services process management, scheduling algorithms, and Performance evaluation.
Module II(6L)	Memory Management: Memory management without swapping or paging, swapping, virtual memory, page replacement algorithms, modeling paging algorithms, design issues for paging systems, and segmentation. Inter-process Communication and synchronization, the need for inter-process synchronization, mutual exclusion, semaphores, and hardware sport for mutual exclusion, queuing implementation of semaphores, classical problems in concurrent programming, critical region, and conditional critical region, monitors, messages, deadlocks.
Module III(4L)	File Systems: File systems, directories, file system implementation, and security protection mechanisms. Input/Output: Principles of I/O Hardware: I/O devices, device controllers, direct memory access.
Module IV(6L)	Disks: Disk hardware, scheduling algorithms, Error handling, trac-at-a-time caching, RAM Disks. Clocks: Clock hardware, memory-mapped terminals, I/O software. Terminals: Terminal hardware, memory-mapped terminals, I/O software.
Module V(4L)	Processes and Processors in Distributed Systems: Threads, system models, processor Allocation, scheduling, Distributed File Systems: Design, implementation, trends.
Module VI(8L)	Assemblers: Elements of Assembly Language Programming, Design of the

	Assembler, Assembler Design Criteria, Types of Assemblers, Two-Pass Assemblers, One-Pass Assemblers, and Single-pass Assembler for Intel x86, Algorithm of Single Pass Assembler, Multi-Pass Assemblers. Compilers: Causes of Large Semantic Gap, Binding and Binding Times, Data Structure used in Compiling, Scope Rules, Memory Allocation, Compilation of Expression, Compilation of Control Structure, Code Optimization.

References:

1. Deitel. H. M. "An Introduction to Operating Systems". Addison Wesley Publishing Company 1984. Milenkovic, M., "Operating Systems· Concepts and Design". McGraw Hill International Edition Computer Science series 1992.
2. Peterson, J. L. Abraham Silberschatz. "Operating System Concepts". Addison Wesley Publishing Company 1989.
3. Tanenbaum, A.S., "Modem Operating Systems", Prentice Hall of India Pvt. Ltd. 1995.

Course Objective:

- Students will learn how Operating System is Important for Computer System.
- To make aware of different types of Operating System and their services.
- To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- To know virtual memory concepts.
- To learn secondary memory management.

Course Outcomes:

CO#	Course Outcomes
CO1	Understands the different services provided by Operating System at different level
CO2	They learn real life applications of Operating System in every field
CO3	Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock
CO4	They will learn different memory management techniques like paging, segmentation and demand paging, etc
CO5	Compare file naming in Linux and Windows.
CO6	Awareness of Android Operating System

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	2	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	2	3	3	2	2	1

CO4	3	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	1	1	2	2	2	1	3	2
CO6	2	1	3	3	2	2	2	3	2	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Python Programming

Paper Code: 2203223

Module 1(L6)	Introduction To Python -Installation and Working with Python Understanding Python variables Python basic Operators Understanding python blocks. Python Data Types -Declaring and using Numeric data types: int, float, complex Using string data type and string operations Defining list and list slicing Use of Tuple data type. Python Program Flow Control -Conditional blocks using if, else and elif Simple for loops in python For loop using ranges, string, list and dictionaries Use of while loops in python Loop manipulation using pass, continue, break and else Programming using Python conditional and loops block
Module 2(L6)	Python Functions, Modules And Packages - Organizing python codes using functions Organizing python projects into modules Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules, and external packages. Python String, List And Dictionary Manipulations -Building blocks of python programs Understanding string in build methods List manipulation using in build methods Dictionary manipulation Programming using string, list and dictionary in build functions
Module 3(L6)	Python File Operation -Reading config files in python Writing log files in python Understanding read functions, read(), readline() and readlines() Understanding write functions, write() and writelines() Manipulating file pointer using seek Programming using file operations. Python Object Oriented Programming – Oops Concept of class, object and instances Constructor, class attributes and destructors Real time use of class in live projects Inheritance , overlapping and overloading operators Adding and retrieving dynamic attributes of classes Programming using Oops support
Module 4(L6)	Python Regular Expression -Powerful pattern matching and searching Power of pattern searching using regex in python Real time parsing of networking or system data using regex Password, email, url validation using regular expression Pattern finding programs using regular expression. Python Exception Handling - Avoiding code break using exception handling Safe guarding file operation using exception handling Handling and helping developer with error code Programming using Exception handling

Module 5(L6)	Python Database Interaction -SQL Database connection using python Creating and searching tables Reading and storing config information on database Programming using database connections. Python Multithreading - Understanding threads Forking threads Synchronizing the threads Programming using multithreading
Module 6(L6)	Contacting User Through Emails Using Python -Installing smtp python module Sending email Reading from file and sending emails to all users addressing them directly for marketing. Python CGI Introduction -Writing python program for CGI applications Creating menus and accessing files Server client program

References:

2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
3. Learning Python, Mark Lutz, Orielly
4. Think Python, Allen Downey, Green Tea Press
5. Core Pyth on Programming, W.Chun, Pearson
6. Introduction to Python, Kenneth A. Lambert, Cengage

Course Objectives:

- To acquire programming skills in core Python.
- To acquire Object Oriented Skills in Python.
- To develop the skill of designing Graphical user Interfaces in Python.
- To develop the ability to write database applications in Python.

Course Outcomes:

CO#	Course Outcomes
CO1	Understand and comprehend the basics of python programming.
CO2	Demonstrate the principles of structured programming and be able to describe, design, implement, and test structured programs using currently accepted methodology.
CO3	Explain the use of the built-in data structures list, sets, tuples and dictionary.
CO4	Make use of functions and its applications.
CO5	Identify real-world applications using oops, files and exception handling provided by python.
CO6	Implement database and GUI applications.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	1	2	1	1	2	1	3
CO3	3	1	2	2	2	2	2	3	2	2	2	1

CO4	3	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: NUMERICAL ANALYSIS
Paper Code: 2191224

Module 1(L8)	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS: Solution Of Algebraic And Transcendental Equations – Fixed Point Iteration Method – Newton Raphson Method- Solution Of Linear System Of Equations – Gauss Elimination Method – Pivoting – Gauss Jordan Method – Iterative Methods Of Gauss Jacobi And Gauss-Seidel – Matrix Inversion By Gauss Jordan Method – Eigen Values Of A Matrix By Power Method.
Module 2(L8)	INTERPOLATION AND APPROXIMATION: Interpolation With Unequal Intervals – Lagrange's Interpolation – Newton's Divided Difference Interpolation – Cubic Splines – Interpolation With Equal Intervals – Newton's Forward And Backward Difference Formulae.
Module 3(L4)	NUMERICAL DIFFERENTIATION AND INTEGRATION: Approximation Of Derivatives Using Interpolation Polynomials – Numerical Integration Using Trapezoidal, Simpson's 1/3 Rule
Module 4(L2)	Romberg's Method – Two Point And Three Point Gaussian Quadrature Formulae – Evaluation Of Double Integrals By Trapezoidal And Simpson's 1/3 Rules.
Module 5(L6)	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS: Single Step Methods – Taylor's Series Method – Euler's Method – Modified Euler's Method – Fourth Order Runge-Kutta Method for Solving First Order Equations – Multi Step Methods – Milne's and Adams- Bash Forth Predictor Corrector Methods for Solving First Order Equations.
Module 6(L8)	BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS: Finite Difference Methods For Solving Two-Point Linear Boundary Value Problems – Finite Difference Techniques For The Solution Of Two Dimensional Laplace's And Poisson's Equations On Rectangular Domain – One Dimensional Heat Flow Equation By Explicit And Implicit (Crank Nicholson) Methods – One Dimensional Wave Equation By Explicit Method.

References:

1. S.A. Mollah, "Introduction to Numerical Analysis", Books & Allied Ltd; 3rd Revised edition (2012)

2. Grewal. B.S., And Grewal. J.S., "Numerical Methods in Engineering And Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
3. Gerald. C. F., And Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.3
4. Chapra. S.C., And Canale. R .P., "Numerical Methods for Engineers, Tata McGraw Hill, 5th Edition, New Delhi, 2007.
5. Brian Bradie. "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
6. Sankara Rao. K., "Numerical Methods for Scientists And Engineers", Prentice Hall Of India Private, 3rd Edition, New Delhi, 2007.

Course Objectives:

- To understand the Potential pitfalls of numerical computations.
- Able to solve a big system of linear equations.
- Able to determine the roots of nonlinear equations.
- Able to construct the interpolating polynomial.
- Able to get the numerical solutions of Initial and boundary value problem.

Course Outcomes:

CO#	Course Outcomes
CO1	Understanding the theoretical and practical aspects of the use of numerical methods
CO2	Implementing numerical methods for a variety of multidisciplinary applications
CO3	Establishing the limitations, advantages, and disadvantages of numerical methods
CO4	Understand the difference operators and the use of interpolation.
CO5	Understand numerical differentiation and integration and numerical solutions of ordinary and partial differential equations.
CO6	Understand numerical techniques to find the roots of non-linear equations and solution of system of linear equations.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	3	1	2	1	3
CO3	3	1	2	3	2	1	2	1	2	2	2	1
CO4	2	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: MANAGEMENT INFORMATION SYSTEM

Paper Code: 2206125

Module I (6L)	INTRODUCTION: Technology of Information Systems, concepts, definition; role and impact of MIS; role and importance of management; approaches to management; functions of the manager; management as a control system; concepts of data models; database design; client-server architecture.
Module II (6L)	PROCESS OF MANAGEMENT: Planning, organization, staffing, coordination and controlling; management by exception; MIS as a support to management; organization structure and theory; basic model and organization structure; organizational behavior.
Module III (8L)	DECSION-MAKING AND INFORMATION: Decision making concepts, methods, tools and procedures; behavioral concepts in decision-making; organizational decision making; information concepts as a quality product; classification of the information; methods of data and information collection; value of the information; organization and information system concepts, control types; handling system complexity; post implementation problems in systems.
Module IV (4L)	SYSTEM ANALYSIS AND DESIGN: Need for system analysis; system analysis of existing system; new requirement; system development model; structured system analysis and design; computer system design;
Module V (6L)	development of MIS; development of long range plans of the MIS; ascertaining the class of the information; determining the information requirement; development and implementation of the MIS; management of quality; MIS factors of success and failure.
Module VI (6L)	DECISION SUPPORT SYSTEMS: Deterministic systems; artificial intelligence; knowledge based systems; MIS and the role of DSS; enterprise management systems; enterprise resource planning (ERP); ERP features and benefits; implementation factors of ERP; Internet and Web based information system; Electronic Commerce.

References:

1. Management Information Systems, K. C Landon, J. P. Laudon, Prentice Hall, 2000.
2. Management Information Systems, G. B. Davis, M. H. Olson, McGraw Hill, 1998.

Course Objectives:

- To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.

- To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.
- To enable students understand the various knowledge representation methods and different expert system structures as strategic weapons to counter the threats to business and make business more competitive.
- To enable the students to use information to assess the impact of the Internet and Internet technology on electronic commerce and electronic business and understand the specific threats and vulnerabilities of computer systems.
- To provide the theoretical models used in database management systems to answer business questions.

Course Outcomes:

CO#	Course Outcomes
CO1	Relate the basic concepts and technologies used in the field of management information systems;
CO2	Compare the processes of developing and implementing information systems.
CO3	Outline the role of the ethical, social, and security issues of information systems.
CO4	Translate the role of information systems in organizations, the strategic management processes, with the implications for the management.
CO5	Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization.
CO6	Application of the theoretical models used in database management systems to answer business questions.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	2	3	2	3	2	1
CO4	2	1	2	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	2	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

SEMESTER III

PAPER NAME: Artificial Intelligence

Paper Code: 2203231

Module I (6L)	General Issues and Overview of AI the AI problems, what is an AI technique, and Characteristics of AI applications. Introduction to LISP programming: Syntax and numeric functions, Basic list manipulation functions, predicates and conditionals, input-output and local variables, iteration and recursion, property lists and arrays.
Module II (6L)	Problem Solving, Search and Control Strategies General problem solving, production systems, control strategies forward and backward chaining, exhaustive searches depth first breadth-first search. Heuristic Search Techniques Hill climbing, branch and bound technique, best first search & A* algorithm, AND / OR graphs, problem reduction & AO* algorithm, constraint satisfaction problems.
Module III (6L)	Knowledge Representations First order predicate calculus, skolemization, resolution principle & unification, interface mechanisms, horn's clauses, semantic networks, frame systems and value inheritance, scripts, conceptual dependency.
Module IV (6L)	Natural Language processing Parsing techniques, context free grammar, recursive transitions nets (RNT), augmented transition nets (ATN), case and logic grammars, and semantic analysis. Game playing Minimax search procedure, alpha-beta cutoffs, additional refinements.
Module V (6L)	Planning Overview an example domain the block word, component of planning systems, goal stack planning, and non-linear planning. Probabilistic Reasoning and Uncertainty Probability theory, Bayes theorem and Bayesian networks, certainty factor.
Module VI (6L)	Expert Systems Introduction to expert systems and application of expert systems, various expert system shells, vidwan framework, knowledge acquisition, case studies, MYCIN. Learning: Rote learning, learning by induction, explanation-based learning.

References:

1. Elaine Rich and Kevin Knight “Artificial Intelligence” - Tata McGraw Hill.
2. “Artificial Intelligence” 4 ed. Pearson.
3. Dan W. Patterson “Introduction to Artificial Intelligence and Expert Systems”, Prentice India.
4. Nils J. Nilson “Principles of Artificial Intelligence”, Narosa Publishing House.
5. Clocksin & C.S.Melish “Programming in PROLOG”, Narosa Publishing House.
6. M.Sasikumar, S.Ramani etc. “Rule based Expert System”, Narosa Publishing House.

Course Objectives:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes:

CO#	Course Outcomes
CO1	Understand the informed and uninformed problem types and apply search strategies to solve them.
CO2	Apply difficult real life problems in a state space representation so as to solve them using AI techniques likesearching and game playing.
CO3	Design and evaluate intelligent expert models for perception and prediction from intelligent environment.
CO4	Formulate valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
CO5	Demonstrate and enrich knowledge to select and apply AI tools to synthesize information and develop models withinconstraints of application area.
CO6	Examine the issues involved in knowledge bases, reasoning systems and planning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	3	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	2	3	2	2	2	1	2	3	2	2	2	1
CO4	3	1	1	1	2	3	1	2	3	3	1	2
CO5	3	2	3	2	3	1	1	2	2	2	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Theory of Computation

Paper Code: 2203232

Module I(7L)	Finite Automata: DFA, NFA, Recognition of a language by an automaton, Equivalence of DFA and NFA, Minimization of FA, Equivalence of FAs
Module II(7L)	Regular Languages: Pumping Lemma for Regular Languages, Closure Properties

	of Regular Sets.
Module III(6L)	Context-free Languages: Non-regular languages, CFLs, Closure properties of CFLs. Grammars, Ambiguity.
Module IV(6L)	Push-Down Automata: Push-Down Automata, Pumping Lemma for CFL.
Module V(8L)	Turing Machines: Introduction to Context Sensitive Languages and Grammers, Turing Machines and its variants, Universal TMs, Halting Problem, Recursive Functions and Sets, Recursively Enumerable Sets, Arithmetization of TMs.
Module VI(6L)	Basics of Complexity Theory: Space and Time Complexity, Ram programs and TMs, PTIME, NP, PSPACE etc., Polynomial reducibility.

References:

1. Elements of the Theory of Computation. Harry Lewis, Christos Papadimitriou, Second Edition, Pearson Education,1998.
2. Introduction to Automata Theory, Languages and Computation. John Hopcroft, Rajeev Motwani, and Jeffrey Ullman. Second Edition. Pearson Education, 2001.
3. Formal Languages and Automata- Peter Linz , Narosa Pub. 4th edn.
4. Theory of computer Science: Automata, Language and Computation - KLP Mishra N Chandra Sekhran - PHI, 3rd edn.

Course Objectives:

1. You will broaden your knowledge of the fundamental mathematical and computational principles that are the foundation of computer science
2. To understand the concept of Deterministic Finite Automata and Non-Deterministic Finite Automata
3. To understand the Push Down Automaton algorithm
4. To understand the basic concepts of Turing Machine.
5. To understand various mathematical models applied to Turing machines.

Course Outcomes:

CO#	Course Outcomes
CO1	Formalization of the notion of problems via formal languages.
CO2	Formalization of the notion of computation using "abstract computing devices" called automata
CO3	Understanding a hierarchy of classes of problems or formal languages (regular, context-free, context-sensitive, decidable, and undecidable)and Understanding a hierarchy of classes of automata (finite automata, pushdown automata, and Turing machines)
CO4	Recognise and comprehend formal reasoning about languages and Show a

	competent understanding of the basic concepts of complexity theory
CO5	Students will be able to apply mathematical and formal techniques for Solving problems in computer science.
CO6	Explain the relationship among language classes and grammars with the help of Chomsky Hierarchy

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	2	3	2	2	3	1	2	3	2	3	2	1
CO4	3	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

Paper Name: Operation Research
Paper Code: 2191135

Unit I: Basic Operation Research (4L)	Basics of Operational Research: Origin & Development of Operational Research, Definition and Meaning of Operational Research, Different Phases of an Operational Research Study, Scope and Limitations of Operational Research, Mathematical Modeling of Real Life Problems.
Unit II: Linear Programming (8L)	Linear Programming: Introduction to Linear algebra. Solution of a system of Linear Equations, Linear independence and dependence of vectors, Concept of Basis, Basic Feasible solution, Convex sets. Extreme points, Hyperplanes and Half spaces, Convex cones, Polyhedral sets and cones.
Unit III: Application of Linear Programming (6L)	LSTM Recurrent Neural Networks: "Understanding LSTM Networks" blog post, optionally the original paper Long Short Linear Programming Problem Formulation, solution by Graphical Method, Theory of Simplex Method, Simplex Algorithm, Two phase Method, Charnes-M Method, Degeneracy, Theory of Duality, Dual-simplex method.
Unit IV: Problem Solutions in Operation Research (6L)	Transportation problem (TP) and its formulation. finding a basic feasible solution of TP using North-West Corner Rule, Least Cost and Vogel's Approximation Method, MODI method for finding optimal solution for TP, Assignment problem and its formulation, Hungarian method for solving Assignment problem, Transhipment and Travelling salesmen problem.
Unit V: Different Methods of Operation Research (4L)	Revised Simplex Method, Bounded Variable linear programming problem, Interior point algorithm for linear programming problem.

Unit VI: Linear Integer Programming (6L)	Introduction to linear integer programming, Branch and Bound Technique, Gomory's Cutting Plane Algorithm for pure and mixed linear integer programming problem, E-Bala's Algorithm for 0-1 programming problem, Real life applications of linear Integer Programming Problem.

Suggested Books:

1. G. Hadley: Linear Programming. Narosa, Reprint, 2002.
2. G. Hadley: Linear Algebra, Narosa, Reprint, 2002.
3. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.
4. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005.
5. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.

Course Objectives:

- To explain the concept of Operational Research
- Explain the fundamental concept of applications of Operation Research
- To discuss the methods of implementing Mathematics in Computer Applications

Course Outcomes:

CO#	Course Outcomes
CO1	Understand the theory of Basic Operation Research
CO2	Define the design of Linear Programming
CO3	Identify the significance of applications of Linear Programming
CO4	Apply and solve different problems of Operation Research
CO5	Learn different methods of Operation Research
CO6	Discuss Linear Integer Programming

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	2	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	3	1	2	2	2	1	2	3	2	2	2	1
CO4	2	1	1	1	2	3	1	1	3	2	1	2
CO5	3	2	2	2	3	1	2	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Accounting and Management Control
Paper Code: 2203234

Module I(8L)	THE CONCEPTUAL FOUNDATIONS OF CONTROL SYSTEMS: Meaning, Nature, and purpose of control systems – The new paradigms of Management Control Systems, four elements of control, organizational structure, organizational goals, organizational climate, strategic planning – Balancing the four levers of control, balancing the tensions in control systems, six sources of tensions in control systems, opportunities and limitations of the span of control, key control variables, delegation, and decentralization, mutual supportive management systems.
Module II(8L)	THE TRADITIONAL INSTRUMENTS OF CONTROL IN ORGANIZATIONS: External audit, internal controls, internal audit, role of financial controllers, multiple roles of an auditor, management control process, budgetary control, flexible budget, zero base budget, performance budgeting, master budget, analysis of variance, accounting aspect of control, management audit, marketing and distribution control, different types of audit.
Module III(6L)	ACCOUNTABILITY IN ORGANIZATIONS: Dual focus and accountability, differentiate between product costing and accountability, the concept of responsibility centre, management control structure, responsibility accounting, cost centre, profit centre, investment centre, ABC costing, transfer prices, CVP analysis, process control.
Module IV(6L)	THE NEW DIMENSIONS OF CONTROL WITH STRATEGIES: Behavioral aspect of management control, motivations, morale, participative management, learning curves, HR accounting, knowledge management control, management control with reference to risk management, differentiated controls for different situations, measuring performance to match strategy, balanced score cards.
Module V(4L)	MANAGEMENT CONTROL IN SPECIALIZED ORGANIZATIONS: Sectoral applications, controlling the financial sector, the banking sector, the balance sheet concept, the concept of schedule of advances, the use of ABC costing standard, insurance, system of insurance accounts,
Module VI(4L)	Non-profit organizations, legal environment of non-profit organization, public service organizations, public utility accounts, holding company accounts, government and co-operative business, control in projects, the twelve step process of designing controlling system.

Course Objectives:

- To enhance the abilities of learners to develop the concept of management accounting and its significance in the business.

- To enhance the abilities of learners to analyze financial statements.
- To enable the learners to understand, develop and apply the techniques of management accounting in the financial decision-making in the business corporates.
- To make the students develop competence with their usage in managerial decision-making and control.

Course outcome:

CO#	COURSE OUTCOMES
CO1	Apply management accounting and its objectives in facilitating decision-making and apply and analyze different types of activity-based management tools through the preparation of estimates.
CO2	Analyze cost-volume-profit techniques to determine optimal managerial decisions.
CO3	Perform cost variance analysis and demonstrate the use of standard costs in flexible budgeting.
CO4	Prepare analyses of various special decisions, using relevant management techniques.
CO5	Calculate various accounting ratios, reports and relevant data.
CO6	Prepare a master budget and demonstrate an understanding of the relationship between the components and prepare Cash Flow and Funds Flow statements this helps in planning for intermediate and long-term finances

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	2	1	1	1	2	2	1	1	2	1	3
CO3	2	1	3	2	2	1	2	3	2	2	2	1
CO4	3	1	1	1	2	3	1	1	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

SEMESTER III

Elective-List (SEM III)

PAPER NAME: Data Mining & Warehousing
Paper Code: 2204123-(A)

Module I (6L)	DATA WAREHOUSING, BUSINESS ANALYSIS AND ON-LINE ANALYTICAL PROCESSING (OLAP): Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.
Module II (6L)	DATA MINING – INTRODUCTION: Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.
Module III (6L)	DATA MINING – FREQUENT PATTERN ANALYSIS: Mining Frequent Patterns, Associations and Correlations – Mining Methods-Pattern Evaluation Method – Pattern Mining in Multilevel, Multi-Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns
Module IV (6L)	CLASSIFICATION: Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines –– Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy.
Module V (6L)	CLUSTERING: Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.
Module VI (6L)	WEKA TOOL: Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

References:

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.
2. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP‖, Tata McGraw – Hill Edition, 35th Reprint 2016.
3. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.
4. Ian H.Witten and Eibe Frank, —Data mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

Course Objectives:

- Be familiar with the mathematical foundations of data mining tools.
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification, and clustering.
- Master data mining techniques in various applications like social, scientific, and environmental contexts.
- Develop skills in selecting the appropriate data mining algorithm for solving practical problems.

Course Outcomes:

CO#	COURSE OUTCOMES
CO1	Design Data Warehouses to solve real-world problems
CO2	Assess the raw input data, and process it to provide suitable input for a range of data mining algorithms
CO3	Discover and measure interesting patterns from different kinds of databases
CO4	Evaluate and select appropriate data mining algorithms and apply, and interpret and report the output appropriately
CO5	Understand and deploy appropriate classification and clustering techniques
CO6	Implement the Data Mining techniques to conceptualize a Data Mining solution to a practical problem

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	1	1	1	2	2	1	1	2	1	3

CO3	2	1	2	2	2	1	2	3	2	2	2	1
CO4	3	1	1	1	2	2	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	1	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Compiler Design
Paper Code: 2204123-(B)

Module I (6L)	INTRODUCTION TO COMPILERS: Translators-Compilation and Interpretation-Language processors-The Phases of Compiler-Errors, Encountered in Different Phases-The Grouping of Phases-Compiler Programming Language basics.
Module II (6L)	LEXICAL ANALYSIS: Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.
Module III (6L)	SYNTAX ANALYSIS: Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies- Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item- Construction of SLR Parsing Table -Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC-Design of a syntax Analyzer for a Sample Language.
Module IV (6L)	SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT: Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator – Type Systems-Specification of a simple type checker- Equivalence of Type Expressions-Type Conversions.
Module V (6L)	RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation- Parameter Passing-Symbol Tables-Dynamic Storage Allocation-Storage Allocation in FORTRAN.
Module VI (6L)	CODE OPTIMIZATION AND CODE GENERATION: Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator – A Simple Code Generator Algorithm.

References:

1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers – Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.
4. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", 2008.

Course Objectives:

1. Provide an understanding of the fundamental principles of compiler design.
2. Provide the skills needed for building compilers for various situations that one may encounter in a career in Computer Science.
3. Learn the process of translating a modern high-level language to executable code required for compiler construction.

Course Outcomes:

CO#	COURSE OUTCOMES
C01	Explain the concepts and different phases of compilation with compile time error handling.
CO2	Represent language tokens using regular expressions, context-free grammar, and finite automata and design a lexical analyzer for a language.
CO3	Compare top-down with bottom-up parsers, and develop an appropriate parser to produce a parse tree representation of the input.
CO4	Generate intermediate code for statements in a high-level language.
CO5	Design syntax directed translation schemes for a given context-free grammar.
CO6	Apply optimization techniques to intermediate code and generate machine code for high level language programs.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	2	3	3	3
CO2	2	3	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	2	3	2	2	2	1
CO4	3	1	2	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2

CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Distributed Database System

Paper Code: 2204123-(C)

Module I (8L)	INTRODUCTION: Definition –Relation to computer system components – Motivation –Relation to parallel systems – Message-passing systems versus shared memory systems –Primitives for distributed communication – Synchronous versus asynchronous executions –Design issues and challenges. A model of distributed computations: A distributed program –A model of distributed executions –Models of communication networks –Global state – Cuts –Past and future cones of an event –Models of process communications.
Module II (2L)	Logical Time: A framework for a system of logical clocks –Scalar time –Vector time – Physical clock synchronization: NTP.
Module III (6L)	MESSAGE ORDERING & SNAPSHOTS: Message ordering and group communication: Message ordering paradigms–Asynchronous execution with synchronous communication–Synchronous program order on an asynchronous system –Group communication – Causal order (CO) – Total order. Global state and snapshot recording algorithms: Introduction –System model and definitions –Snapshot algorithms for FIFO channels
Module IV (6L)	DISTRIBUTED MUTEX & DEADLOCK: Distributed mutual exclusion algorithms: Introduction – Preliminaries – Lamport‘s algorithm – Ricart-Agrawala algorithm – Maekawa‘s algorithm – Suzuki–Kasami‘s broadcast algorithm. Deadlock detection in distributed systems: Introduction – System model – Preliminaries – Models of deadlocks – Knapp‘s classification – Algorithms for the single resource model, the AND model, and the OR model
Module V (8L)	RECOVERY & CONSENSUS: Check-pointing and rollback recovery: Introduction – Background and definitions – Issues in failure recovery – Checkpoint-based recovery – Log-based rollback recovery – A coordinated check-pointing algorithm – Algorithm for asynchronous check-pointing and recovery. Consensus and agreement algorithms: Problem definition – Overview of results – Agreement in a failure–free system – Agreement in synchronous systems with failures.
Module VI (6L)	P2P & DISTRIBUTED SHARED MEMORY: Peer-to-peer computing and overlay graphs: Introduction – Data indexing and overlays – Chord – Content addressable networks – Tapestry. Distributed shared memory: Abstraction and advantages – Memory consistency models –Shared memory Mutual Exclusion.

References:

1. Pradeep K Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
2. Mukesh Singhal and Niranjan G. Shivaratri. Advanced concepts in operating systems. McGraw-Hill, Inc., 1994.
3. Tanenbaum A.S., Van Steen M., —Distributed Systems: Principles and Paradigms‖, Pearson Education, 2007.
4. Liu M.L., —Distributed Computing, Principles and Applications‖, Pearson Education, 2004.
5. Nancy A Lynch, —Distributed Algorithms‖, Morgan Kaufman Publishers, USA, 2003.

Course Objectives:

1. The purpose of the course is to enrich the previous knowledge of database systems and expose the need for distributed database technology to confront the deficiencies of centralized database systems.
2. Introduce basic principles and implementation techniques of distributed database systems.
3. Equip students with principles and knowledge of parallel and object-oriented databases.
4. Topics include distributed DBMS architecture and design; query processing and optimization; distributed transaction management and reliability; parallel and object database management systems.

Course Outcomes:

CO#	COURSE OUTCOMES
C01	Fragment a database both horizontally and vertically for optimal performance.
CO2	Allocate replicas of fragments for best performance.
CO3	Optimize queries for optimal performance across a distributed database.
CO4	Add distributed transaction management control including concurrency control and replica control to a distributed database.
CO5	Demonstrate expertise in reading peer-reviewed papers in distributed databases and explaining them in writing.
CO6	Discuss how current database products implement database distribution including query optimization.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	3	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	2	3	2	2	2	1
CO4	3	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	3	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: AI & Neural Network
Paper Code: 2204123-(D)

Module I(6L)	Introduction: AI problems, the foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem-solving agents, problem formulation.
Module II(6L)	Searching: Searching for solutions, uniformed search strategies – Breadth-first search, depth-first Search. Search with partial information (Heuristic search) Greedy best-first search, A* search Game Playing: Adversarial search, Games, minimax, algorithm, optimal decisions in multiplayer games, Alpha-Beta pruning, Evaluation functions, cutting of search.
Module III(6L)	Knowledge Representation & Reasons logical Agents, Knowledge–Based Agents, the Wumpus world, logic, propositional logic, Resolution patterns in propositional logic, Resolution, Forward & Backward. Chaining. First-order logic. Inference in first-order logic, propositional Vs. first-order inference, unification & lifts forward chaining, Backward chaining, Resolution.
Module IV(6L)	Characteristics of Neural Networks, Historical Development of Neural Networks Principles, Artificial Neural Networks: Terminology, Models of Neuron, Topology, Basic Learning Laws, Pattern Recognition Problem, Basic Functional Units, Pattern Recognition Tasks by the Functional Units.
Module V(6L)	Feedforward Neural Networks: Introduction, Analysis of pattern Association Networks, Analysis of Pattern Classification Networks, Analysis of Pattern Storage Networks. Analysis of Pattern Mapping Networks. Feedback Neural Networks: Introduction, Analysis of Linear Auto associative FF Networks, Analysis of Pattern Storage Networks.
Module VI(6L)	Competitive Learning Neural Networks & Complex pattern Recognition Introduction, Analysis of Pattern Clustering Networks, Analysis of Feature Mapping Networks, and Associative Memory.

References:

1. Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/ Pearson Education.
2. Artificial Intelligence, 2nd Edition, E.Rich, and K.Knight (TMH).
3. Artificial Intelligence and Expert Systems – Patterson PHI.
4. Neural Networks Simon Haykin PHI.
5. Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition.

Course Objectives:

- Understand the context of neural networks and deep learning
- Know how to use a neural network
- Understand the data needs of deep learning
- Have a working knowledge of neural networks and deep learning
- Explore the parameters for neural networks

Course Outcomes:

CO#	COURSE OUTCOMES
C01	Understand the difference between a biological neuron and an artificial neuron
CO2	Understand the application areas of neural networks
CO3	Understand the building blocks of Neural Networks
CO4	Develop neural network models
CO5	Design and develop applications using neural networks
CO6	Learn to design and build neural network models and develop learning algorithms for machine learning

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	3	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	2	3	2	2	2	1
CO4	3	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Cryptography and Network Security

Paper Code: 2204123(E)

Module I (2L)	INTRODUCTION: Services, Mechanisms, and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).
Module II (4L)	FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat‟s and Euler‟s theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.
Module III (6L)	BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY:

	Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.
Module IV (6L)	HASH FUNCTIONS AND DIGITAL SIGNATURES: Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.
Module V (8L)	SECURITY PRACTICE & SYSTEM SECURITY: Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall-related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.
Module VI (10L)	E-MAIL, IP & WEB SECURITY: E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IP Security: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

References:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan: Cryptography and Network Security, Wiley India Pvt.Ltd
2. Behrouz A. Foruzan, Cryptography and Network Security, Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a PUBLIC World, Prentice Hall, ISBN 0-13-046019-2

Course Objectives:

- To understand basics of Cryptography and Network Security.
- To be able to secure a message over insecure channel by various means.
- To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
- To understand various protocols for network security to protect against the threats in the networks.

- To make the student learn different encryption techniques along with hash functions, MAC, digital signatures and their use in various protocols for network security and system security.

Course Outcomes:

CO#	COURSE OUTCOMES
CO1	Identify and analyze network security attacks and counter-measures to prevent those attacks.
CO2	Analyze and design classical encryption techniques and block ciphers.
CO3	Analyze the applications of discrete mathematics and understand their implementation incryptography.
CO4	Apply the knowledge of existing encryption and decryption techniques to provide security solutions.
CO5	Assess the impact of public key cryptosystems and key management to ensure a secure exchange ofinformation.
CO6	Investigate the security requirements and solutions for maintaining Data integrity using moderntechniques for data transmission.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	3	1	2	2	2	1	2	3	2	1	2	1
CO4	2	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	2	3	1	3	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

Paper Name: Machine Learning
Paper Code: 2204123(F)

Module I (6L)	Introduction-Towards Intelligent Machines, Well posed Problems, Examples of Applications in diverse fields, Data Representation, Domain Knowledge for Productive use of Machine Learning, Diversity of Data: Structured / Unstructured, Forms of Learning, Machine Learning and Data Mining, Basic

	Linear Algebra in Machine Learning Techniques.
Module II (6L)	Supervised Learning- Rationale and Basics: Learning from Observations, Bias and Why Learning Works: Computational Learning Theory, Occam's Razor Principle and Overfitting Avoidance Heuristic Search in inductive Learning, Estimating Generalization Errors, and Metrics for assessing regression, Metris for assessing classification.
Module III (6L)	Statistical Learning- Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in learning techniques, Bayesian Reasoning: A probabilistic approach to inference, K-Nearest Neighbor Classifier. Discriminant functions and regression functions, Linear Regression with Least Square Error Criterion, Logistic Regression for Classification Tasks, Fisher's Linear Discriminant and Thresholding for Classification, and Minimum Description Length Principle.
Module IV (6L)	Support Vector Machines (SVM) - Introduction, Linear Discriminant Functions for Binary Classification, Perceptron Algorithm, Large Margin Classifier for linearly separable data, and Linear Soft Margin Classifier for Overlapping Classes, Kernel Induced Feature Spaces, Nonlinear Classifier, and Regression by Support vector Machines.
Module V (6L)	Learning with Neural Networks: Towards Cognitive Machine, Neuron Models, Network Architectures, Perceptrons, Linear neurons and the Widrow-Hoff Learning Rule, The error correction delta rule. Multilayer Perceptron Networks and error backpropagation algorithm, Radial Basis Functions Networks.
Module VI (6L)	Decision Tree Learning: Introduction, Example of the classification decision tree, measures of impurity for evaluating splits in decision trees, ID3, C4.5, and CART decision trees, pruning the tree, strengths, and weakness of decision tree approach.

References:

1. Applied Machine Learning, M. Gopal, McGraw Hill Education
2. Machine Learning: A Probabilistic Perspective, Kevin Murphy, MIT Press, 2012
3. The Elements of Statistical Learning, Trevor Hastie, Robert Tibshirani, Jerome Friedman, Springer 2009 (freely available online)
4. Pattern Recognition and Machine Learning, Christopher Bishop, Springer, 2007
5. Programming Collective Intelligence: Building Smart Web 2.0 Applications - Toby Segaran
6. Building Machine Learning Systems with Python - WilliRichert, Luis Pedro Coelho

Course Objectives:

- Identify problems that are amenable to solution methods, and which AI methods may be suited to solving a given problem.

- Analyze a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
- Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
- Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.

Course Outcomes:

CO#	COURSE OUTCOMES
CO1	Learn the basics of learning problems with a hypothesis and version spaces
CO2	Understand the features of machine learning to apply to real-world problems
CO3	Characterize the machine learning algorithms as supervised learning and unsupervised learning and Apply and analyze various algorithms of supervised and unsupervised learning
CO4	Analyze the concept of neural networks for learning linear and non-linear activation functions
CO5	Learn the concepts in Bayesian analysis from probability models and methods
CO6	Understand the fundamental concepts of Genetic Algorithms and Analyze and design the genetic algorithms foroptimization engineering problems

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	3	3	3	3
CO2	3	1	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	2	2	1	1	3	2	2	2	1
CO4	1	1	1	1	2	3	3	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

Paper Name: Internet of Things
Paper Code: 2204123(G)

Module I(6L)	Introduction to IoT: Understanding IoT fundamentals, IOT Architecture and protocols, Various Platforms for IoT, Real-time Examples of IoT, Overview of IoT components and IoT Communication Technologies, Challenges in IoT

Module II(6L)	Arduino Simulation Environment: Arduino Uno Architecture, Setup of the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button and buzzer with Arduino, Interfacing Arduino with LCD
Module III(6L)	Sensor & Actuators with Arduino: Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino. Interfacing of Relay Switch and Servo Motor with Arduino
Module IV (6L)	Basic Networking with ESP8266 WiFi module: Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server-introduction, installation, configuration, Posting sensor(s) data to web server
Module V (6L)	IoT Protocols: M2M vs. IOT, Communication Protocols
Module VI(6L)	Cloud Platforms for IOT, Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services -- SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, ThingSpeak API and MQTT, Interfacing ESP8266 with Web services

References:

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.
3. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
5. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”,1st Edition, VPT, 2014
6. Francis da Costa, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, A press Publications, 2013
7. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 978-14493-9357-1

Course Objectives:

- Describe what IoT is and how it works today
- Recognise the factors that contributed to the emergence of IoT
- Design and program IoT devices
- Use real IoT protocols for communication
- Secure the elements of an IoT device
- Design an IoT device to work with a Cloud Computing infrastructure.
- Transfer IoT data to the cloud and in between cloud providers

- Define the infrastructure for supporting IoT deployments

Course Outcomes:

CO#	COURSE OUTCOMES
CO1	Understand the working of smart sensors in IOT context.
CO2	Apply knowledge in usage of smart devices, Gateways and Data Management in IoT.
CO3	Understand the vision of IoT from a local as well as global context.
CO4	Apply IoT to resolve many Industrial cum Commercial Building Automation and Real World DesignConstraints.
CO5	Determine the Market trends of IoT in smart sensing.
CO6	Apply filtering techniques to process data toward reaching accurate decisions.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	3	3	1	1	2	2	1	1	2	1	3
CO3	2	1	2	3	2	1	2	3	2	3	2	1
CO4	3	1	1	1	2	1	1	2	3	2	1	2
CO5	3	2	3	2	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	2	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

PAPER NAME: Cloud Computing
Paper Code: 2204123(H)

Module VI (6L)	Introduction to Cloud Computing: What is a cloud, Definition of Cloud Computing, Characteristics of Cloud Computing, Driving factors towards the cloud, Architecture, How Cloud Computing Works, Role of Networks in Cloud computing, protocols used, Role of Web services.
Module VI (6L)	Service Models: IaaS, PaaS, SaaS, NaaS, Cloud Clients, Deployment Models: Public Clouds, Community Clouds, Hybrid Cloud, Private Cloud, Issues in Cloud Computing, Applications.
Module III (8L)	Infrastructure as a Service(IaaS): IaaS definition, Introduction to virtualization, Different approaches to virtualization, Resource Virtualization- Server, Storage,

	Network, Hypervisors, Machine Image, Virtual Machine(VM), Data storage in cloud computing(storage as a service), Examples like Amazon EC2-Renting, EC2 Compute Unit, Platform and Storage, pricing, customers.
Module IV (5L)	Platform as a Service (PaaS): What is PaaS, Service Oriented Architecture (SOA), Cloud Platform and Management, Examples like Google App Engine.
Module V (5L)	Software as a Service (SaaS): Introduction to SaaS, Web services, Web 2.0.
Module VI(6L)	Overview of Security Issues, Infrastructure Security: Network level security, Host level security, Application level security, Data security, and Storage, Challenges and Risks of Cloud Computing Platforms and Cloud Services.

References:

a. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles and paradigms, 2011
b. Michael Miller, Cloud Computing, 2008

Course Objectives:

- The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure.
- The topic introduces students to various concepts like cloud systems, parallel processing in the cloud, distributed storage systems, virtualization, security in the cloud, and multicore operating systems.
- Students will study state-of-the-art solutions for cloud computing developed by Google, Amazon, Microsoft, etc.

Course Outcomes:

CO#	COURSE OUTCOMES
C01	To develop an understanding of computing paradigms and compare them.
CO2	To be able to choose a particular deployment model according to the scenario.
CO3	Design and develop the cloud and implement various services on the cloud.
CO4	To develop an understating of virtualization technology and its different dimensions.
CO5	Investigate the issues and challenges in implementing cloud security and mobile cloud security.
CO6	Compare and contrast various open and proprietary cloud platforms.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	3	3	2	3	3	2	1	3	3	3
CO2	2	1	3	1	1	2	2	1	1	2	1	3
CO3	3	1	2	3	2	3	2	3	2	2	2	1

CO4	2	1	1	1	2	3	1	2	3	2	1	2
CO5	3	2	3	1	3	1	1	2	2	1	3	2
CO6	2	1	3	3	2	2	1	3	3	1	3	1

Highly Correlated: 3
Moderately Correlated: 2
Slightly Correlated: 1

Industrial Training:

Industrial Training for MCA students plays really a big role in their future growth. As we know that industrial training is a necessity for any technical education or we can say that now a day's industrial training is the backbone of every technical education.

To get closer one step to the industries, we need to adapt according to the changing needs and scenarios of the industries. Industrial training provides us the insight to understand the actual behavior of the industry and what is the interaction we follow after we enter the industry.

The Courses we cover in the Industrial training program for MCA students are:

- Python
- PHP
- Android and IOS app development
- Advanced Digital Marketing
- Web designing and development
- Google Ad-word
- Social media marketing
- Natural Language Processing

Advantages:

- To build strength, teamwork spirit, and self-confidence in students' life.
- Assist students to evaluate and understand how work experience relates to their personal or career and future professional development
- To build good communication skills with the group
- To Develop employability, skills, intellectual skills, the core of key skills, personal attributes, and knowledge about how organizations work
- Maintain and develop links between the university, the placement provider, and the community.
- Develop professional skills and strengthen the application of theory to practice.
- Enhance students' familiarity with the world of work and enable them to reflect constructively on issues related to work