B. Tech Computer Engineering

(Theory Courses)

Syllabus

Department of Computer Engineering

Jamia Millia Islamia

B. TECH. COMPUTER ENGINEERING COURSE STRUCTURE UNDER THE CHOICE BASED CREDIT SYSTEM (CBCS)

Codes for nature of courses

L : Lecture courses

P : Laboratory Based courses

S: Seminar/ Independent Study

Category of Courses

CORE : Departmental courses

Weight age for Course Evaluation

L : Lecture T : Tutorial P : Practical CCA : Continuous Class Assessment MTE :Mid Term Exam

B. TECH. COMPUTER ENGINEERING-II YEAR (Effective from July 2018)

	Third Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods/ week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	T	P	CCA	MTE -1	MTE -2		
THEORY		**Third Semester**										
01	CEN-301	Mathematics – III	**Core**	4	3	1	-	10	15	15	60	100
02	CEN-302	Discrete Mathematics	**Core**	4	3	l	-	10	15	15	60	100
03	CEN-303	Data Structure	**CBCS**	4	3	l	-	10	15	15	60	100
04	CEN-304	Digital Logic Theory	**Core**	3	2	1	-	10	10	10	45	75
05	CEN-305	Analog & Digital Communication	**Core**	3	2	1	-	10	10	10	45	75
PRACTICAL (LAB.)												
06	CEN-391	Data Structure Lab	**Core**	2	**-**	**-**	4	10	10	10	20	50
07	CEN-392	C Programming Lab	**Core**	2	**-**	**-**	4	10	10	10	20	50
08	CEN-393	Digital Logic Design Lab	**Core**	1	**-**	**-**	2	15	-	-	10	25
		Total		**23**								**575**
THEORY		**Fourth Semester**										
01	CEN-401	Mathematics- IV	**Core**	4	3	1	**-**	10	15	15	60	100
02	CEN-402	Computer Organization	**Core**	3	2	1	**-**	10	10	10	45	75
03	CEN-403	System Software	**Core**	3	2	1	-	10	10	10	45	75
04	CEN-404	Operating System	**Core**	4	3	1	**-**	10	15	15	60	100
05	CEN-405	Database Management System	**CBCS**	4	3	1	**-**	10	15	15	60	100
PRACTICAL (LAB.)												
06	CEN-491	DBMS Lab	**Core**	2	-	-	4	10	10	10	20	50
07	CEN-492	Linux Lab	**Core**	2	-	-	4	10	10	10	20	50
08	CEN-493	Operating System Lab	**Core**	2	-	-	4	10	10	10	20	50
		Total		**24**							**Total**	**600**

B. TECH. COMPUTER ENGINEERING COURSE STRUCTURE UNDER THE CHOICE BASED CREDIT SYSTEM (CBCS)

B. TECH. COMPUTER ENGINEERING -III YEAR (Effective from July 2019)

	Fifth Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods/ week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Semester Evaluation	Total Marks
					L	T	P	CCA	MTE-1	MTE-2		
THEORY				**Fifth Semester**								
01	CEN-501	Computer Architecture	**Core**	3	2	1	-	10	10	10	45	75
02	CEN-502	Automata Theory	**Core**	4	3	1	-	10	15	15	60	100
03	CEN-503	Microprocessor	**Core**	3	2	1	-	10	10	10	45	75
04	CEN-504	Object Oriented Programming	**Core**	4	3	1	-	10	15	15	60	100
05	CEN-505	Computer Networks	**CBCS**	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB.)												
06	CEN-591	Object Oriented Prog. Lab	**Core**	2	-	-	4	10	10	10	20	50
07	CEN-592	Microprocessor Lab	**Core**	1	-	-	2	15	-	-	10	25
08	CEN-593	Computer Network Lab	**Core**	2	-	-	4	10	10	10	20	50
		Total		**23**								**575**
THEORY				**Sixth Semester**								
01	CEN-601	Analysis & Design of Algorithm	**CBCS**	4	3	1	-	10	15	15	60	100
02	CEN-602	Software Engineering	**Core**	3	2	1	-	10	10	10	45	75
03	CEN-603	Compiler Design	**Core**	4	3	1	-	10	15	15	60	100
04	CEN-604	Embedded System	**Core**	4	3	1	-	10	15	15	60	100
05	CEN-605	Internet Protocols	**Core**	3	2	1	-	10	10	10	45	75
PRACTICAL (LAB/SEMINAR)												
06	CEN-691	Embedded System lab	**Core**	2	-	-	4	10	10	10	20	50
07	CEN-692	Compiler Lab	**Core**	2	-	-	4	10	10	10	20	50
08	CEN-693	Seminar	**Core**	1	-	-	2	15	5	5	-	25
		Total		**23**							**Total**	**575**

B. TECH. COMPUTER ENGINEERING COURSE STRUCTURE
UNDER THE CHOICE BASED CREDIT SYSTEM (CBCS)

B. TECH. COMPUTER ENGINEERING –IV YEAR (Effective from July 2020)

	Seventh Semester											
S.No.	Course No.	Course Name	Type of Course	Credit	Periods/ week			Examination Scheme (Distribution of Marks)				
								Mid Semester Evaluation			End Sem. Evaluation	Total Marks
					L	T	P	CCA	MTE-1	MTE-2		
THEORY				**Seventh Semester**								
01	CEN-701	Data Mining	**CBCS**	4	3	l	-	10	15	15	60	100
02	CEN-70X	Elective – I	**Core**	4	3	l	-	10	15	15	60	100
03	CEN-70X	Elective – II	**Core**	4	3	1	-	10	15	15	60	100
04	CEN-70X	Elective – III	**Core**	4	3	1	-	10	15	15	60	100
PRACTICAL (LAB./MINOR PROJECT)												
05	CEN-791	Data Mining Lab	**Core**	2	-	-	4	10	10	10	20	50
06	CEN-792	Minor Project	**Core**	4	-	-	8	0	30	30	40	100
		Total		**22**								**550**
THEORY				**Eighth Semester**								
01	CEN-807	Natural Language Processing & Information Extraction	**CBCS**	4	3	l	**-**	10	15	15	60	100
02	CEN-80X	Elective – I	**Core**	4	3	l	-	10	15	15	60	100
03	CEN-80X	Elective - II	**Core**	4	3	1	**-**	10	15	15	60	100
PRACTICAL (LAB./MAJOR PROJECT)												
05	CEN-891	NLP Lab	**Core**	2	-	-	4	10	10	10	20	50
06	CEN-892	Major Project	**Project**	10	-	-	20	80	40	30	100	250
		Total		**21**								**600**

List of Electives in 7th Semester

CEN – 702: Mobile Communication
CEN – 703: Artificial Intelligence
CEN – 704: Parallel & Distributed Computing
CEN – 705: Optimization Techniques
CEN – 706: Computer Graphics
CEN – 707: Management Science

List of Electives in 8th Semester

CEN – 801: Software Project Management
CEN – 802: Internet Technologies
CEN – 803: BlockChain Technology
CEN – 804: Software Testing
CEN – 805: Network Security
CEN – 806: Soft Computing

TOTAL CREDITS FROM III TO VIII SEMESTER: 136

TOTAL CREDITS FROM I TO VIII SEMESTER: 188

TOTAL MARKS FROM III TO VIII SEMESTER: 3475

CEN- 302: DISCRETE MATHEMATICS

L	T	P		Internal:	40 Marks
3	1	0		External:	60 Marks
Credits : 4				**Total:**	**100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to use logical notation to define and reason about fundamental concepts such as sets, relations, and algebraic structures.
2. Students will be able to model problems in Computer Science using graphs and trees.
3. Students will be able to prove elementary properties of recurrence relations and explain their applications in Computer Science
4. Students will be able to synthesize proofs using induction hypotheses, combinatorics, inclusion-exclusion, propositions. etc,.
5. Students will be able to model and optimize the combinational problems using LPPs.

UNIT 1: Algebraic Structures

Review of Relations, equivalence relations, partial orders, Hash function, characteristics function. Algebraic structure: Semi-groups, Monoids, Groups, Permutation groups, Rings, Fields, Integral domain, Lattice.

UNIT 2: Graph Theory

Definition and properties of graphs, directed and undirected graphs, degree sequence, cycles, path, connectivity, adjacency matrix, incidence matrix. Complete graphs, Regular graphs, Bipartite graphs, Planar graphs. Graph Isomorphism. Euler circuit, Hamiltonian circuit. Coloring of graphs: Welch-Powell algorithm, Dijkstra's shortest path algorithm.

UNIT 3: Recurrence Relations

Introduction, Generalized linear homogenous/non-homogenous recurrence relations, common recurrence relations. Solving recurrence relations: Iteration method, characteristic equation method. Introduction to generating functions. Solving recurrences using generating functions. Solving simultaneous recurrences.

UNIT 4: Mathematical Techniques

Propositional calculus, Principle of inclusion and exclusion, Pigeonhole principle, Principle of mathematical induction, Permutation and combination, Recursive functions, Boolean algebra.

UNIT 5: Linear Programming Problems

Introduction, Formulation of LPP, Solution of LPP: Graphical methods, Simplex algorithm. Duality principle.

BOOKS:

1. K. H. Rosen, Discrete Maths and its Applications, McGraw Hill International Editions.
2. C. L. Liu, Elements of Discrete Mathematics, McGraw Hill International Editions.
3. Thomas Koshy, Discrete Maths with Applications, Elsevier Academic Press.
4. E. G. Goodaire, Discrete Maths with Graph Theory, Pearson.
5. J L Mott, A Kandel, T P Baker, Discrete Maths for Computer Scientists & Mathematicians, Pearson.
6. Kolman, Ross & Busby, Discrete Mathematical Structures, Pearson
7. K. D. Joshi, Foundations of Discrete Maths, Wiley Eastern Ltd.

CEN- 303: DATA STRUCTURE

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to understand the different Data Structures and its complexity and their uses along with their applications in the related problem.
2. Students should be able to understand the concepts of Stack and Queue and its related concepts and should be able to write algorithms based on these concepts.
3. Students should be able to understand different types of Link List and should be able to write algorithm on this topic.
4. Students will be able to understand tree data structure and their different types and should be able to solve competitive level questions on the topic.
5. Students should thoroughly understand graph data structure and should be able to apply it to solve the problems. They should also be well versed with sorting algorithms along with their complexity.

UNIT 1:

Definition of Data Structure, Types & characteristics of Data structures, Abstract Data Type (ADT), Algorithms: Algorithm Concepts, Objectives of algorithms, Quality of an algorithm, Space complexity and Time complexity of an algorithm.

Characteristics of an array, Definition of an Array, Implementation of 1-D arrays, Row and Column Major Implementations of 2-D, 3-D and n-D arrays.

Advanced concept of Pointers in C, Dynamic allocation of Memory. Program related to Arrays and Pointers.

UNIT 2:

Stack as a ADT, operations on stack, Stack implementation using array and linked list, Applications of Stack: Polish and reverse Polish notations, Recursion, Garbage collection. Queue as ADT, Operations on queue, and Types of queues: Linear Queue, Circular Queue, Priority Queue, and Double Ended Queue, Applications of Queue.

UNIT 3:

Concept of a Linked List, Linear Single and Double link lists, Circular Single and Double link List, Generalized Linked List, Header Linked list, Applications of Link List.

UNIT 4:

Concepts of a Tree, Tree as ADT, Definitions of n-ary, binary trees, Terms associated with trees. Operations on tree, Tree Search Algorithms, Binary Search Tree, Tree traversal Algorithms, AVL Trees, Threaded binary trees, Heap Tree, Expression tree, Huffman Tree, B – Tree and B+ Tree.

UNIT 5:

Graph: Different terminology associated with Graphs, Types of graphs – directed/undirected, connected/disconnected, cyclic/acyclic, Representation of graphs: Adjacency matrix, linked list. Graph Traversal – BFS, DPF, Graph algorithm-Warshall’s, Djikastra’s, Minimum Spanning Tree – Prim’s and Kruskal’s Algorithm.

Sorting Algorithms - Sequential Sort, Shell Sort, Insertion Sort, Merge Sort, Quick Sort, Topology sort.

Recommended Books:

- Data Structure, Seymour Lipschutz, Schaumn Series, Tata McGraw publications.
- An Introduction to Data Structure with Applications by Trembley and Sorenson, McGraw Hill education.
- Fundamentals of Data Structure in C by Horowitz, Sahni and Anderson-Freed, University Press.
- Data Structure and Algorithm – John Beidler, Springer.

CEN- 304: DIGITAL LOGIC THEORY

L T P		Internal:	30 Marks
2 1 0		External:	45 Marks
Credits : 3		**Total:**	**75 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1. Students should thoroughly understand how to represent numbers and perform arithmetic in different bases, Encode symbols and numbers in binary codes.
2. Students should learn to evaluate and simplify logical functions using Boolean algebra and karnaugh map.
3. Students will be able to Implement logic functions with basic gates, NAND-NAND and NOR-NOR logic.
4. Students will be able to design and analyze combinational logic circuits containing adders, multiplexers, decoders, demultiplexers etc.
5. Students should thoroughly understand the functionality of flip-flops for analysis and design of sequential circuits like counters, shift registers etc.

UNIT 1: BOOLEAN ALGEBRA AND LOGIC GATES

Introduction, Binary numbers, Base-conversions, Octal and hexadecimal numbers, complements, binary codes, concept of fixed and floating point numbers, Axiomatic definition of Boolean Algebra, Basic Theorems and properties. Boolean functions and representation in canonical and standard forms, SOP and POS forms, other logic operations,

UNIT 2: FUNCTION MINIMIZATION

Digital logic gates. Karnaugh map methods, limitations of K-maps for larger variables, POS-simplification, NAND/NOR implementation, other 2-level implementations, Don't-care conditions, Tabular method.

UNIT 3: COMBINATIONAL SYSTEMS-I

Hardware aspect of arithmetic logic functions, Half-Adder, Full-Adder, Binary Adder/Subtractor, Decimal Adder,

UNIT 4: COMBINATIONAL SYSTEMS-II

Magnitude Comparator, Demultiplexer, Multiplexer, encoder, Priority Encoder, Parity Checker/Generator,

UNIT 5: SEQUENTIAL SYSTEMS

Definition and state representation, Flip-Flops, RS, D, JK-M/S, their working characteristics, State Tables, Excitation Tables and triggering, Asynchronous and Synchronous Counters-Design and Analysis, Counter Applications, Description and Operations of Shift Registers, Shift Register/Counters.

Books :

- W.I. Fletcher, "An Engineering Approach to Digital Design", PHI, 1990.
- R.J. Tocci, "Digital Systems: Principles, and Applications", PHI 1990.
- T.C. Bartee, "Digital Computer Fundamentals", McGraw Hill, 1994.

CEN- 305: ANALOG AND DIGITAL COMMUNICATION

L T P		Internal:	30 Marks
2 1 0		External:	45 Marks
Credits : 3		**Total:**	**75 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1. Students will be able to describe the different elements of communication medium, needs of modulation and analog modulation techniques
2. Students will be able to describe the generating and demodulating of analog signal
3. Students will be able to describe different communication medium for analog and digital communications
4. Students will be able to Understand of different ADC and DTA modulation and demodulation techniques, multiplexing, switching techniques
5. Students will be able to describe different digital modulation techniques and techniques used for transmission of digital signals over communication channels.

UNIT – I

Classification of signals, difference between analog & digital signals, elements of a communication system, limitations in communications. Modulation: Needs & Methods. Analog Modulation, Frequency Modulation, Phase Modulation.

UNIT- II

Generation and detection of AM &amp; FM signals. Radio transmitters and receivers. Introduction to transmitting &amp; receiving Antennas. PLL, AGC, AFC, Tracking Diversity.

UNIT- III

Concept of BW, Noises & Channel Capacity of different communication systems, twisted wire, Coaxial cable, Fiber-optics, Wave guides, Microwave, satellite GEO, MEO, and LEO etc.

UNIT- IV

Information Capacity, sampling Theorem, pulse modulation, PAM, PPM, PWM, Pulse Code Modulation (PCM), The Complete PCM system ,Delta modulation, Comparison of PCM & DM, Adaptive DM, Differential PCM (DPCM), Communication Multiplexing (TDM, FDM), Switching (Circuit, Message, & Packet).

UNIT – V

PSK, FSK, DPSK, variation of PSK, FSK, Synchronous & Asynchronous Communication, Start Stop bit data transfer. Bit level transfer & Byte level data transfer, Line Coding, Modems (Synchronous & Asynchronous) Error detection and correction methods (Parity bit, Block Parity, hamming Code, Checksum error detection etc.), Retransmission strategies.

References / Text Books:

- Electronic Communication by John Kenedy.Advanced
- Introduction to Digital & Data Communication by Micheal A miller.
- Electronic Communication by Sanjay Sharma.
- Lathi, B.P., Modern Digital and Analog Communication Systems, Third Edition, Oxford University Press
- Communication Electronics by Louis E. Frenzel Jr.
- Electronics Communication by Wayne Tomasi.

CEN - 402: COMPUTER ORGANIZATION

L T P	Internal:	30 Marks
2 1 0	External:	45 Marks
Credits : 3	**Total:**	**75 Marks**
Duration of Exam : 3 Hours		

Course Outcomes:

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1. Students will be able to understand the functions of
    a. Basic components of a computer system.
    b. Instruction execution, register transfer and micro-operations
2. Students will be able to design
    a. Hardwired Control Unit
    b. Microprogrammed Control Unit
3. Students will be able to design
    a. Cache Memory
    b. Main Memory
4. Students will be able to understand I/O mechanisms.
5. Students will be able to understand basic parallel organizations.

Unit 1

INTRODUCTION TO COMPUTER ORGANIZATION: Introduction, Basic Computer Organization – CPU, Memory, I/O, Performance Metrics, CPU organization - ALU, CU, Registers, Von Neumann Principle, Machine Instructions, Instruction Execution Cycle, Register Transfer and Microoperations, Hardware Design of Microoperations.

Unit 2

PROCESSING UNIT: Processing Unit – Instructions and Operations, Control Unit implementation, Special Purpose Register Organization, Design of Hardwired Control, Microprogram Sequencer, Design of Microprogrammed Control, Horizontal and Vertical Microprogram.

Unit 3

MEMORY SUBSYSTEM: Memory Organization - Memory Hierarchy, Concept of Cache Memory, Mapping Techniques, Cache Organization and Design, Replacement Algorithms, Write Policies, Main Memory Unit - Internal organization of a Memory chip, Interleaved Memory, DRAM Chip Design.

Unit 4

INPUT/OUTPUT SUBSYSTEM: Access of I/O devices, I/O ports, I/O interfaces, Program controlled I/O, Interrupt controlled I/O, DMA controlled I/O.

Unit 5

HIGH PERFORMANCE PROCESSOR: Parallel Processing – Introduction and Classification, Multiprocessors, Pipelining, Interconnection Networks, Static and Dynamic Networks. Selected Topics in Computer Organization.

Text Books:

- John D. Carpinelli **“Computer Systems Organization and Architecture”** Pearson Education.
- William Stallings, **“Computer Organization and Architecture: Designing for Performance”** 9th Edition, Pearson Education, 2013.
- M. Morris Mano, **“Computer System Architecture”** Prentice Hall, 1993

Reference Books:

- D.A. Patterson and J.L. Hennessy, “**Computer Organization and Design, the Hardware/Software Interface**”, Morgan Kaufmann, 1994.
- V.C.Hamacher, Z.G. Vranesic and S.G. Zaky, **“Computer Organization”**, 4th edition, McGraw Hill, 1996.

CEN- 403: SYSTEM SOFTWARE

L	T	P	Internal:	30 Marks
3	1	0	External:	45 Marks
Credits : 3			**Total:**	**75 Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Students will be able to understand the fundamental of translators including Intermediate code generation of Compiler, language processing, language grammar, and address modifications uses along with their applications in the related problem.
2. Students will be able to understand the concept of pseudo assembly language programming, design specifications of assembler with pass I and pass II assembler design, intermediate code generation of assembler in variant I and variant II and should be able to generate machine code and intermediate code of assembly language programs.
3. Students will be able to understand the concept of Macros in programming including macro expansion, MEC processing and Macro preprocessor design and should be able to solve questions on the topic.
4. Students should thoroughly understand loading and linking concepts with the functions of loader and linker, types of address binding, Students will be able to understand the basics and advance concepts of Linux operating system with their commands.
5. Students should thoroughly understand I/O redirection, Piping, basics of Shell with advance shell scripting and should be able to make shell scripts efficiently.

UNIT 1:

LANGUAGE PROCESSOR: Introduction, fundamental of language processing and specification, language processor development tools, Data structure of language processing, scanning and parsing. Machine structure and Machine language.

UNIT 2:

INTRODUCTION TO ASSEMBLER DESIGN: Elements of assembly language programming, review of instruction format, Addressing modes, Functions of Assembler, Design of Assemblers: single pass assemblers, two pass assembler.

UNIT 3:

MACROS & LINKERS: Macros processors: Macro instruction, features of macro preprocessor, implementation of Macros, Relocation and linking concept, Design of linker, self-relocating program, linking of overlays.

UNIT 4:

LINUX COMMANDS: Linux basic commands, File system, I/O Redirection and piping, processes in Linux, Communication commands.

UNIT 5:

LINUX SHELL PROGRAMMING: Decision, Loops- while, until and for loops, break and continue, File meta characters, Functions of shell, exporting variables, traping signals, shell variables $?, $$, $#, $*, $1, system administration.

Books:

- System programming and operating system By D.M. Dhamdere, TMH 2nd Revised edition.
- System programming By John J. Donovan , TMH Reprint 2005.
- Unix programming By Allen Cox , Wrox publication
- Unix shell Programming By Yashvant Kanetker.

CEN- 404: OPERATING SYSTEM

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to describe the functions and structure of operating systems
2. Student will be able to understand the principles of process management, and possess the ability to apply various scheduling algorithms,
3. Ability to compare and contrast various memory management schemes
4. Student will be able to understand the principles of concurrent execution, synchronization, deadlock detection and avoidance and possess the ability to apply various algorithms
5. Design various disk systems, file systems and I/O sub systems

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UNIT – I INTRODUCTION AND OPERATING SYSTEM STRUCTURES

Definition, What Operating System Do, Single Processor Systems, Multiprocessor/parallel Systems. Concept of Multiprogramming, Time-sharing System, Operating System Operation: Dual Mode Operation: Kernel Mode, User Mode. Distributed system, Real Time system, Process Management, Memory Management, Storage Management. Protection and security, Operating System Services, thread, multithreading model, System Call, Types of System calls, System Programs, process, cooperating process-Inter process communication, Operating system structure, User Operating- System Interface, multiprocessor system

UNIT- II PROCESS CONCEPT AND SCHEDULLING

The Process, Process State, Process Control Block, Process Scheduling, Operations on Processes, Concept of Threading. Schedulers, Scheduling Criteria, Scheduling Algorithms: First Come, First Served (FCFS), Shortest Job First(SJF), Shortest Remaining Time First(SRTF) , Longest Job First(LJF) , Longest Remaining Time First(LRTF), Highest Response Ratio Next (HRRN), Priority Scheduling, Round Robin Scheduling, Multilevel Queue Scheduling(MLQ), Multilevel Feedback Queue(MLFQ) Scheduling, Multiprocessor Scheduling. Algorithm evaluation, deterministic modeling, queueing models.

UNIT- III MEMORY-MANAGEMENT STRATEGIES

Background: Basic Hardware, Address Binding, Logical vs. Physical Address Space. Swapping, Contiguous Memory Allocation, fixed partition, Best-Fit, First-Fit and Worst-Fit Memory Allocation Method, dynamic partitioning, compaction, protection and sharing, Buddy System, fragmentation-internal and external , Non-Contiguous Allocation, Paging, hardware support for paging, Translation Look Aside Buffer, Protection , shared pages, Structure of Page Table, Hierarchical Paging, Hashed Page Table, Inverted Page Table, Segmentation, Segmentation with paging, Virtual Memory: Background, swapping, Demand paging, Page Replacement Algorithms, First in First out(FIFO),Least-recently-used(LRU), optical page replacement, clock page replacement, Least Frequently Used(LFU), Belady’s Anomaly, Second-Chance Algorithm, Enhanced Second-Chance Algorithm, thrashing

UNIT- IV SYNCHRONIZATION AND DEADLOCK

Background, The Critical- Section Problem, Race condition, Synchronization Hardware, Peterson’s Solution, Semaphores, Mutex and Classical Problems of Synchronization: Bounded- Buffer Problem, The Reader- Writers Problem, Sleeper barber problem, Dining- Philosophers Problem, Monitors Usage, Synchronization problem Solution using Monitors, System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Banker’s Algorithm, Deadlock Detection, Recovery from Deadlock

UNIT – V FILE-SYSTEM INTERFACE AND MASS- STORAGE STRUCTURE

File Concept, Access methods, Directory and Disk Structure, file-System Mounting, file sharing, protection File-system structure, file-system implementation, Directory implementation, Allocation Methods. Free-space Management, efficiency and performance

Secondary Storage Disk- structure, Disk- scheduling: FCFS,SSTF,SCAN,C-SCAN,LOOK,C-LOOK Scheduling algorithms, RAID

References / Text Books:

- Operating system concepts: Silberchatz Galvin, Gagne: john Wiley & Sons, inc.2007
- Operating systems: A Concept-based approach: D M Dhamdhere 2nd edition TMH 2007
- Operating systems: Deitel Deitel Choffnes 3rd edition Pearson Education 2007
- Milenkovic, Milan: Operating system concepts and Design, McGraw Hill, 1994.e.g. Mac or Linux Operating System, Bash Shell, Gedit, GCC
- http://quiz.geeksforgeeks.org/

CEN- 405: Data Base Management System

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to develop a conceptual design of a database using Entity Relationship Model for a given Scenario.
2. Student will be able to apply normalization techniques to minimize data redundancy.
3. Student will be able to write SQL queires to retrieve data for a given scenario.
4. Student will be able to explain the principles of various concurrency control and deadlock recovery.
5. Student will be able to understand how data is stored and retrieved in application specific databases: Temporal, spatial, Multimedia, Web, Mobile, Distributed databases.

UNIT 1 : DATA MODEL IMPLEMENTATION AND E-R DIGRAM

Database – Characteristics, advantages, disadvantages and applications. Data models - Hierarchical , Network and relational model. Three schema architecture and data independence. Client server architecture for DBMS. Classification of DBMS Data modeling using E-R diagram, Entity type, entity sets, attribute and keys. Weak entity. Relational model concepts, Relational database schemas, Constraint violations. Introduction to Tuple relational calculus, Domain relational calculus, relational algebra

UNIT 2 : NORMALIZATION AND DATA REDUNDENCY

Design guidelines for Relational schemas, Functional dependency, Normal forms based on primary keys. Definition of First Normal form, Second normal form, Third normal form and BCNF. Multivalued Dependency and Fourth Normal form, Join dependency and fifth Normal form. Inclusion dependency, Other dependencies and Normal form.

UNIT 3 : STRUCTURED QUERY LANGUAGE (SQL)

SQL: Data Manipulation, Data Definition, Commercial RDMS: Oracle / MySql / Sql Server , PL/SQL . PL/SQL programming, views, cursors and Trigger.

UNIT 4: TRANSACTION MANAGEMENT

Transaction processing concepts, Locks, Serializability and Concurrency Control, Database Security.

UNIT 5 : EMERGING AREAS IN DATABASE AND DATA MODELS

Introductions to Distributed database, Object oriented database, Mobile database, Multimedia database, Geographic Information system, data warehousing and data mining

Books:

- "Fundamentals of Database Systems", Elmasri, Navathe, Pearson Education, IVth Edition. Pearson Education.
- "Database system concepts", Henry F Korth, Abraham Silberschatz, S. Sudurshan, McGraw-Hill.
- "An Introduction to Database Systems", C.J.Date, Pearson Education.
- "Data Base System", Michael kifer and et all, Pearson Education..
- "Database Management Systems" ,Ramakrishnan, Gehrke;Mcgraw-Hill.
- "The Database Book –Principle and Practice" By Narain Gehani, University Press.
- "A first course in Database Systems", Jeffrey D. Ullman, Jennifer Windon, Pearson Education.

CEN- 501: COMPUTER ARCHITECTURE

L	T	P	Internal:	30 Marks
2	1	0	External:	45 Marks
Credits : 3			**Total:**	**75 Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Student will be able to understand computer organization, design and micro-operations.
2. Student will be able to Understand of CPU functioning and computer arithmetic.
3. Students will be able State and understand various methods and techniques of hardwired and microprogram control unit design.
4. Students will be able to learn from topics in computer architecture, parallelism, addressing and techniques of memory organization.
5. State and compare properties of parallel processors, shared memory and distributed multiprocessor systems.

UNIT 1: INTRODUCTION

Introduction to computer architecture; Moor's law; Evolution of computer architectures and current trends; Performance of a processing unit, different classifications of computer architecture: Flynn's classification scheme, Shore's classification scheme, Feng's and Handler's classification scheme, system attributes and performance measures of parallel computer: speed up, efficiency, Amdahl's Law.

UNIT 2: DESIGN OF ARCHITECTURE

Design of Arithmetic circuit, Logical circuits, ALU, N-bit Parallel Adder, Comparison of Various parallel adders, CLA, CSA, Array Multiplication, sequential multiplier, signed multiplication, unsigned multiplication, designing fast and efficient algorithm for multiplication e.g. Booth Multiplier, integer representation, floating point representation. Range of representation, Floating point operation.

UNIT 3: HARDWIRED CONTROL UNIT DESIGN

Basic concepts and its application to implement hardware loops, Hard wired circuit to compute factorial, sum of series etc., Microprogrammed control ,Designing control unit using hardwired control for booth's multiplication.

UNIT 4: PROCESSORS AND MEMORY HIERARCHY

Instruction Set Architectures, Design Consideration, types of instruction, various addressing scheme: Immediate, Memory and Register References, Displacement Addressing, Stack Addressing, Memory Hierarchy technology: hierarchical memory technology. Inclusion, coherence and locality.

UNIT 5: PARALLEL PROCESSING

Advanced processor technology: Design Space of Processors, CISC and RISC scalar processors, differences between CISC and RISC; scalar, Superscalar, array processor and vector processor, pipeline in various processor like Super pipelined processor, Super pipelined superscalar processor, VLIW processor, multi-processors; NUMA, UMA and COMA models.

Books:

- Kai Hwang, “Advanced Computer architectures, Parallelism, Scalability & Programmability”, McGraw Hill,
- Sima, Fountain & Kacsuk, “Advanced Computer architectures a design space approach”, Pearson education
- John L. Hennessy & David A. Patterson, “Computer Architecture, A Quantitative Approach”, Morgan Kaufmann, 3rd edition, 2003.
- Rafiquzamman and Chandra, “Modern Computer Architecture”. Galgotia Publication.
- J. P. Hayes, “Computer Architecture and Organization”, McGraw Hill, 1998.

CEN- 502: AUTOMATA THEORY

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to understand the different types of Finite Automata, their equivalence and applications.
2. Students should understand the concept of Regular expressions and the use of pumping lemma to solve competitive level questions on this topic.
3. Students will learn about various types of languages and their corresponding grammars, especially the context free grammars along with the various steps involved in their simplification.
4. Students will gain knowledge of the design of PDA for various competitive level problems, construction of PDA from a CFG along with the concept involving use of PDA to build Parsers.
5. Students will understand the working and capabilities of a Turing machine and how to compute with Turing machine along with various classes of problems and about their solvability.

UNIT 1:

INTRODUCTION TO FINITE AUTOMATA: Introduction to Finite Automata, strings, alphabets and languages, graphs & trees, state tables & diagram, NDFA & DFA concepts, Conversion of NFA to DFA, Minimization of FA, Mealy & Moore machines, state and machine equivalence.

UNIT 2:

REGULAR EXPRESSION: Introduction to Regular Expressions, Identities for Regular expressions, Arden's Theorem, Conversion of Finite Automata to Regular Expression, properties of regular languages. Pumping Lemma for Regular sets.

UNIT 3:

CONTEXT FREE GRAMMARS & LANGUAGES: Introduction to Grammars and Lanaguages, Chomsky Classification of languages, Context free Grammar, Left Most & Right Derivations, Derivation tress, Ambiguity, Simplification of CFG, Conversion to Chomsky and Greibach Normal form, Pumping Lemma for context free languages.

UNIT 4:

PUSH DOWN AUTOMATON: Introduction to Push Down Automaton (PDA) for Context Free languages, Basic Design of a PDA, Instantaneous configuration of PDA, Construction of PDA for Context free languages, conversion from CFG to PDA.

UNIT 5:

TURING MACHINES & COMPUTABILITY: Introduction to Turing Machines (TM), Computing with Turing Machines, Non-deterministic TM, context sensitive languages and Linear Bounded Automaton, Church's Thesis, Universal Turing Machines, Primitive Recursive functions**,** Halting Problem of the TM, Unsolvable Problems about Turing Machines, The Class P and NP Languages, NP Completeness, Some NP Complete Problems, Class NP Hard and some NP Hard problems

Books:

- J.E. Hopcroft & J.D. Ullmann, "Introduction to Automata Theory Language and Computation", Narosa Publications.
- K. L. P. Mishra & Chandrasekaran, “Theory of Computer Science: Automata, Languages and Computation”, 3rd Edition, PHI
- H.R. Lewis & C.H. Papadimitrou, "Elements of the Theory of Computation", PHI
- John C. Martin, "Introduction to Languages and the Theory of Computation", McGraw-Hill International
- D.A. Cohen, "Introduction to Computer Theory", John Wiley.

CEN- 503: MICROPROCESSOR

L	T	P	Internal:	30 Marks
2	1	0	External:	45 Marks
Credits : 3			**Total:**	**75 Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Students will be able to understand Timing diagram and architecture of 8085, 8086 and other microprocessors.
2. Students will be able to write and use the instructions in Instruction set of 8085, 8086 correctly.
3. Students will be able to write 8085 programs.
4. Students will have understanding of Interfacing and Interrupt of 8085.
5. Students will be able to develop 8086 Programs, software interrupt and can interface peripheral devices with 8086.

UNIT 1:

Review, Organization and architecture of 8085,8086 and other Microprocessors, Instructions of 8085 & Programming techniques, Machine Language Vs Assembly Language, Basic concepts of timing & control unit, Timing Diagrams for 8085 instructions. Study of important 8 – bit Microprocessors & their Comparison, Introduction to 16 – bit processors – 8086, 8088 and 68000 Coprocessor & comparison. Introduction to 32 – bit Microprocessors.

UNIT 2:

Instruction set of 8085, instruction set of 8086, Syntax and illustration of different types of instructions along with their use.

UNIT 3:

Programs using instruction set of 8085, maximum, minimum, searching ,sorting, division, multiplication, factorial ,conversion from binary to decimal and ASCII, decimal to Binary , matrix addition and other relevant programs using instruction set of 8085, Subroutine, Counter, delay calculations,

UNIT 4:

Minimal System, Necessity for interfacing, Address space partitioning – Memory mapped I / O & I / O Mapped I / O, Advantages and Disadvantages, Types of Interfacing devices – I / O ports, Programmable peripheral interfaces 8255, 8259 (PIC), 8251 (USART), 8253 (Timer), 8279 (Keyboard Controller), Coprocessors. Hardware scheme for data transfer – Programmed Data transfer, Interrupt Data Transfer, Various interrupt Schemes, Multiple Interrupt, Enabling, Disabling and Masking of Interrupts Particularly in 8085, DMA & DMA Controller.

UNIT 5:

TASM , MASM, programs based on 8086 instruction set, Software Interrupt, Assembly language programming in C, Interfacing with 8086, Microprocessors based system design

Books:

- K.M. Bhurchandi and A.K. Ray, Advanced Microprocessor and Peripherals, Tata McGraw Hill
- A.P. Mathur, “An Introduction to Microprocessors” Tata McGraw Hill, 1995.
- K.L. Short, “Microprocessor & Programmed Logic”, 2nd Ed., PHI, 1994
- R.G. Gaonkar, “Microprocessor Architecture programming and application", Wiley Eastern Ltd., 1994.

CEN- 504: OBJECT ORIENTED PROGRAMMING

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	100 Marks

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students should thoroughly understand object-oriented programming principles and techniques such as encapsulation, polymorphism, and inheritance and use them to develop rather complex programs using classes and objects in C++.
2. Students should be able to implement polymorphism features like function overloading and operator overloading.
3. Students will be able to program more advanced C++ features such as composition of objects, dynamic memory allocation, inheritance and virtual function etc.
4. Students should thoroughly understand fundamental features of an object oriented language Java and learn to implement interfaces, abstract classes and packages etc.
5. Students should be able to implement exceptions handling and Multithreading in Java.

UNIT 1: OBJECT ORIENTED PROGRAMMING USING C++

Object Oriented Paradigm, Structured vs Object Oriented Development, Concept of Object and classes, Encapsulation, Polymorphism, Inheritance Generic Programming, Merits and demerits of OOP. Class specification, Class objects, Defining member function, Inline functions, Data Hiding, Empty class, Pointers inside a class, Passing objects as parameters, Returning objects from functions, Friend function and class, Static data and member functions. Constructors and destructors, overloading of constructors, Dynamic initialization through constructors, Copy constructors, Static data members with constructors and destructors. Pointers to objects, Array of objects, this pointer, Self-referential classes.

UNIT 2: IMPLEMENTING POLYMORPHISM IN C ++: OVERLOADING

Function and Operator overloading, Overloading of unary and Binary operators, Limitations of overloading of increment and decrement operators, overloading of arithmetic, Relational, assignment, new and delete, subscript operators. Data conversion between objects. Complete conversion. Overloading through friend functions. Tracing of memory leaks.

UNIT 3: INHERITANCE AND VIRTUAL FUNCTIONS

Declaration of derived class, forms of inheritance, constructors and destructors in derived class, types of inheritance, abstract class, Virtual functions: Need of virtual functions, Pointers to derived class objects, pure virtual functions, Virtual destructors, Rules of writing virtual function

UNIT 4: OBJECT ORIENTED PROGRAMMING USING JAVA

Classes, objects and constructor in Java, Implementing inheritance and polymorphism - dynamic binding, method overriding, abstract classes and methods. Interfaces - Interfaces vs. Abstract classes, defining an interface, implementing interfaces, accessing implementations through interface references, extending interfaces. Packages - Defining, Creating and Accessing a Package, importing packages.

UNIT 5: EXCEPTION HANDLING AND MULTITHREADING

Exception handling - Dealing with errors, benefits of execution handling, the classification of exceptions- exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re throwing exceptions, exception specification, built in exceptions, creating own exception sub classes.

Multithreading - Difference between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads.

Books:

- The C++ Programming Language by B.Stroustrup, Pearson Education.
- Thinking in C++ by Bruce Eckel , Pearson Education
- Object Oriented Programming in C++ by N.Barkakati, PHI
- Mastering C++ by Venugopal and et all, Tata McGraw Hill
- C++ How to Program by Deital and Deital, Pearson Education
- The Complete Reference Java by Herbert Shildt, Tata McGraw Hill

CEN- 505: COMPUTER NETWORKS

L T P		Internal:	40 Marks
3 1 0		External:	60 Marks
Credits : 4		**Total:**	**100 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1. Students will be able to understand Fundamental theories, ISO-OSI, TCP-IP, ATM Reference model and TDM CDMA techniques.
2. Student will be able to understand various switching techniques, Communication media, and Digital Analog formats.
3. Student will be able to understand various Flow Control protocol, Design issues and services of Data Link Layer and Error detection and correction etc.
4. Student will be able to understand Channel allocation Problem, ALOHA-pure and Slotted Aloha, Multiple access protocol, Collision free protocol, IEEE 802.11, Datagram subnet and Virtual Circuit Subnet.
5. Student will be able to understand Network Layer Design issues

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UNIT 1:

Introduction:

Data Networks, LAN, MAN, WAN, Uses of Computer Networks, LAN Technologies- Transmission, Topologies, Access methods. Network Architecture, Protocol and standards, References Model OSI-ISO, TCP/IP – Overview, IP Address, Classes, Sub-netting, Fundamentals of digital communication, Channel capacity, Bit error rate, Multiplexing Techniques- TDM, FDM, CDMA.

UNIT 2:

The Physical Layer:

Theoretical basis for Communication , Guided and Unguided Communication media, Communication Satellites, Digital signal encoding Format- NRZ-L, NRZ-I, Manchester, Differential Manchester, Bipolar, 2B1Q. Switching Techniques- Circuit Switching, Message Switching, Packet switching.

UNIT- 3

The Data Link Layer:

Data Link Layer design issues, Error Detection and Correction, Flow control Protocols, Stop and Wait protocol, Sliding - window Flow control, Error control, stop and wait ARQ, Go-back-N, Selective repeat ARQ, Examples of Data link Protocols- HDLC.

UNIT- 4

The Medium Access Control Sub Layer:

The channel allocation problem, ALOHA, Multiple access Protocols, Collision free Protocols, IEEE Standards for LANs and MANs, Bridges, Wireless LANs, IEEE 802.11, Bluetooth, High speed LANs.

UNIT – 5

The Network Layer:

Network Layer Design issues, Routing Algorithms- Dijsktra's, Bellman-Ford, Link state, Distance vector, Hierarchical Routing. Congestion control Algorithms, Quality of Service, Internetworking, Internet Architecture and Addressing.

Books :

- B.A. Forouzan, " Data Communication and Networking", TMH, 4TH Edition.
- A.S. Tanebaum, " Computer Networks", 4th Edition Pearson Education.
- W. Stallings, " Data and Computer Communication", 7th Edition , Pearson Education.
- Comer E. Doughlas, " Computer Networks and Internet", 2nd Edition Pearson Education.

CEN- 601: ANALYSIS & DESIGN OF ALGORITHMS

L T P		Internal:	40 Marks
3 1 0		External:	60 Marks
Credits : 4		**Total:**	**100 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1 Students will be able to analyze algorithms and to determine asymptotic-complexity orders.
2 Students will be able to get algorithmic design paradigms such as divide-&-conquer and their methods of analysis.
3 Students will be able to demonstrate a number of greedy algorithms for problems in engineering and problems involving graphs.
4 Students will be able to apply learned algorithm design techniques such as dynamic programming, branch & bound, and backtracking to solve real-world problems.
5 Students will be able to solve problems related to string matching and compare algorithms based on their complexity correctness/class.

UNIT I

Introduction: What is algorithm? Why analyze algorithm? RAM Model of Computation. Best-case, worst-case and average-case complexity analyses. Asymptotic Notations: Big-Oh, Big-Omega, Theta notations, Small-oh, Small-omega notations, Rules of notations. Solving recurrence equations: Iterative method, Recursion-tree method, Guess method, Master method, Master’s theorem, and proof of master’s theorem. Rate of growth of functions and their ranking. Review and analysis of searching and sorting algorithms, lower bound of comparison-based sorting.

UNIT II

Divide and Conquer Strategy: Introduction, Counterfeit coin detection, binary search, merge sort, quick sort, integer multiplication, matrix multiplication (Strassen’s algorithm), exponentiation problem, polynomial multiplication, median-finding problem, closest pair of points problem. When to avoid divide-&-conquer strategy.

UNIT III

Graph Algorithm: Introduction, topological sorting, Dijkstra’s algorithm shortest path for weighted graph, DFS algorithm, BFS algorithm, articulation points in bi-connected graph, strongly connected components. Greedy Algorithm: Introduction, change-making problem, Huffman coding, Minimum spanning tree problem, disjoint set data structure, prims and kruskal algorithm, 0/1 knapsack problem, fractional knapsack problem, activity selection problem.

UNIT IV

Dynamic Programming: Introduction, fibonacci series calculation, 0/1 knapsack problem, matrix chain multiplication, Longest common subsequence problem, optimal binary tree search problem, memoization, Floyd-Warshal’s algorithm. Backtracking: The general method, 8-queen problem, sum of subsets.

UNIT V

String Search Problem: Naïve algorithm, Rabin-karp algorithm, FSA based algorithm, knuth-morris-pratt algorithm. Complexity theory: P class of problem, NP-class of problem, Decidability of problems, Halting problem, Polynomial reduction problem, Cook's theorem, NP hardness and NP completeness.

BOOKs:

- T H Cormen, C E Leisersor, and R L Rivest, Introduction to Algorithm, Third Edition, PHI.
- Richard Neapolitan and Kumarss Naimipour, Foundation of Algorithms, Fourtht Edition, Jones & Bartlet.
- A V Aho, J E Hopcroft and J D Ullman, The Design and analysis of computer algorithms, Pearson Education
- E Horwitz, and S Sahni, Fundamentals of Computer Algorithm, PHI
- Goodrich & Tamassia, Algorithm Design, Wiley
- A Levitin, Introduction to the Design & Analysis of Algorithms, 2nd Edition, Pearson Education.

CEN- 602: SOFTWARE ENGINEERING

L	T	P		Internal:	30 Marks
2	1	0		External:	45 Marks
Credits : 3				**Total:**	**75 Marks**
Duration of Exam : 3 Hours					

Course Outcomes:

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1. Students will be able to understand fundamental theories of Software Development life cycle & various SDLC Models.
2. Student will be able to understand various types of Requirements, Techniques for Requirement Elicitation and SRS Document, COCOMO, Risk Management activities etc.
3. Student will be able to understand coupling and Cohesion and its types, Software Reliability and Quality assurance using ISO9001:2008, ISO9001: 2015 Standards and SEI-CMM.
4. Student will be able to understand various types of Software Testing and Generating test cases using various testing approaches and Debugging.
5. Student will be able to understand Software Maintenance, Types of maintenance, various models of maintenance, Software RE-ENGINEERING and REVERSE Engineering and Configuration Management & CASE Tool etc

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Unit 1: Introduction

Definition, Program Vs Software, Software processes, Software life cycle models: Build and Fix, Waterfall, Prototype, Iterative Enhancement Model, Evolutionary and Spiral model, V Model & RAD Model.

Unit 2: Software Project Planning.

Crucial process steps of Requirement Engineering, Types of requirements, Requirement Elicitation techniques and Requirement Documentation, SRS, COCOMO model, Risk management.

Unit 3: Software Requirement Analysis and Specifications, Design & Software Reliability.

Problem Analysis, Data Flow Diagrams, use case diagrams, Software Prototyping, Cohesion & Coupling, Classification of Cohesiveness & Coupling, Function Oriented Design, Object Oriented Design, User Interface Design. Software Reliability: Failure and Faults, Overview of Quality Standards like ISO 9001, SEI-CMM

Unit 4: Software Testing

Software Testing terminology, Functional testing: Boundary value analysis, Equivalence class testing, Cause- effect graphing, Structural testing: path testing, Data flow and mutation testing, unit testing, integration and system testing, Validation testing Debugging techniques & Approaches and Testing Tools.

Unit 5: Software Maintenance

Software Maintenance & its types: Management of maintenance, The Maintenance Process, Maintenance Models: Quick fix, Iterative Enhancement, Reuse Oriented. Reverse Engineering, Software RE-engineering, Configuration Management.

BOOK:

- Prof: KK Aggarwal & Yogesh Singh: SOFTWARE ENGG:
- Pankaj Jalote, " An Integrated Approach to Software Engg" Narosa Publishing House, New Delhi.
  Pressman"Priciples of Software Engg" TMC, 5th Ed. 2005

CEN- 603: COMPILER DESIGN

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Students will be introduced to a Language Processing System and the role a Compiler and the phases within it. There shall a detailed description of the design and role of a Lexical analyzer along with the concept of finite automata
2. Students will understand the various well known types of parsing techniques including the use top down and bottom up approaches for solving competitive level questions.
3. Students will be described about the task performed in the semantic analysis phase along with the evaluation of semantic rules and the concept of type checker in a compiler.
4. Students will gain knowledge about the concept Intermediate Code generation along with various intermediate representations and how intermediate code will be generated for a corresponding high level code.
5. Students will be introduced to the need of performing optimizations and the various types of optimization techniques. Students will also understand the various issues in the design of the code generator and the task of code generation for a given intermediate code.

UNIT 1:

INTRUCTION TO COMPILER AND LEXICAL ANALYSIS PHASE: Introduction to compilation, Language processing system, Analysis of the Source Program, Phases and Passes in compilers, compiler construction tools. Introduction to Lexical analysis, Input buffering, tokens, lexemes & pattern, FA & Regular Expressions, NFA to DFA, Minimization, Specification and recognition of tokens, Design of lexical analyzer generator.

UNIT 2:

SYNTAX ANALYSIS PHASE (PARSING): Role and position of a Parser, A simple Backtracking parser, Predictive Parsing, A review of Context Free Grammar, Derivation tree, Ambiguity. Parsing approaches. Top-down Parsing: LL Parsing; Bottom-Up Parsing technique: LR Parsing, SLR, CLR & LALR Parsing, Error recovery strategies, Yacc: an LALR Parser generator.

UNIT 3:

SEMANTIC ANALYSIS AND TYPE CHECKING: Syntax Directed Definitions and translations, Attributes and Attribute grammar, construction of syntax trees, bottom up evaluation of S attributed definition, Type Checking: Type systems, Specification of simple type checker, Type checking for expression and statements, type conversions.

UNIT 4:

INTERMIDIATE CODE GENERATION: Intermediate representations, Types of TAC statements, TAC implementation, TAC generation for Assignment statements, Declarative statements, Boolean expression & Flow of control statements. Short circuit code, Backpatching.

UNIT 5:

CODE OPTIMIZATION AND TARGET CODE GENERATION: Code Optimization, Principle sources of optimization, Types of Optimizations. Control Flow Analysis, Flow Graph, Dominator, Natural Loops, Data Flow Analysis, Gen-Kill and IN & OUT Computations.

Issues in the design of a code generator, the target machine, code generation from DAG, Heuristic Node Listing Algorithm, Code generation from a tree, Labeling Algorithm, Function Gencode, A simple code generator.

Books:

- Aho, Sethi, Ullmann & Lam “Compilers: Principles, techniques and tools”, Pearson Education Asia
- Keith Cooper & Linda Torczon, "Engineering a Compiler", Morgan Kaufmann publication.
- Levine, Mason, and Brown, “Lex & Yacc”, O’ Reilly publication.
- Vinu V. Das, “Compiler Design using FLEX and YACC” PHI.

CEN- 604: EMBEDDED SYSTEM

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Students will have understanding of Design Challenges and recent trends in Embedded system design.
2. Students will be able to understand Architecture of 8051 ,its memory map and how to interface it with other peripherals to design an embedded system product.
3. Students will be able to understand Instruction set of 8051 and be able to program it for solving various real time problems.
4. Students will be able to understand and program Timer and Counters of 8051 and other microcontrollers for various applications.
5. Students will be able to understand and do serial and interrupt programming of 8051 and ES Design using RTOS and other techniques.

UNIT 1:

Embedded system:- Definition, components, I/O, Processor, Memory, Characteristics, attributes, design metrics , design challenges, application areas, Issues of designing efficient Embedded system, Difference between ES and PC, Design Technology, Integration and Testing of Embedded Hardware and Firmware, Embedded System Development Environment:-IDE, compiler, assembler, simulator, Emulator, debugging, Target hardware debugging and Boundary Scan , EDLC, Trends in the Embedded Industry:-Processor trends, OS trends, Development languages trends, Open Standard and framework, S/W H/W Co-design

UNIT 2:

Microcontroller:-Introduction, criteria for choosing a microcontroller**,** Overview of 8051 Microcontroller family: Architecture, basic assembly language programming concepts, Memory Organization of 8051,SFR, Watch Dog Timer, Real Time clock. Interfacing to an external memory and Accessing External data Memory and External Code Memory, Interfacing to LCD/Keyboard, DAC/ADC, Sensors, a Stepper Motor, Interfacing with 8255

UNIT 3:

Addressing Modes, Instruction set including bit manipulating instruction and programming using it, Subroutine, Stack, , I/O port programming, programs based on the instruction set,

UNIT 4:

Programming of 8051 Timers, Counter Programming. Time delay generations and calculations, Basic Concepts of Interfacing, Introduction to Arm , Pic, and AVR Processors and other recent processors

UNIT 5:

basics of Communication with 8051**,** Basics of Communication, Overview of RS-232, I^{2}C Bus, UART, USB, 8051 connections to RS-232, 8051 serial communication programming, 8051 interrupts, Programming of timer interrupts, Programming of External hardware interrupts, Programming of the serial communication interrupts, Interrupt priority in the 8051,. RTOS:- introduction, type, overview of commercially available RTOS, Introduction to ES design using RTOS ., Soc, NOC,

Books:

- Shibu K V , "Introduction to Embedded Systems" , TMH 2009
- M.A. Mazidi and J. G. Mazidi, "The 8051 Microcontroller and Embedded Systems", PHI, 2004
- Frank Vahid & Tony Givargis, "Embedded System Design ", John Wiley & sons , 2002
- David E. Simon, "An Embedded Software Primer", Pearson Education, 1999.
- Raj Kamal, "Embedded Systems", TMH, 2004.
- K.J. Ayala, "The 8051 Microcontroller", Penram International, 1991.
- Dr. Rajiv Kapadia, "8051 Microcontroller & Embedded Systems", Jaico Press
- Dr. Prasad, "Embedded Real Time System", Wiley Dreamtech, 2004.
- Wayne Wolf, "Computers As Components , Principle of Embedded Computing System Design" , Morgan Kauf man Publishers, 2008.
- Asang Dani & Yashavant Kanetkar, "Go Embedded", BPB Publications, 2008

CEN- 605: PARALLEL COMPUTING

L	T	P	Internal:	30 Marks
2	1	0	External:	45 Marks
Credits : 3			**Total:**	**75 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to understand architecture of parallel and distributed System
2. Students will be able to understand and apply performance laws for evaluation of parallel and Distributed System as well as dependency analysis
3. Students will be able to design and implement pipeline for solving real life problems.
4. Students will able to design parallel algorithm for solving a given problem and to parallelize sequential algorithms.
5. Students will be able to understand and write cluster program using MPI, multi core program using Open Mp and programming massive parallel processor GPU using CUDA.

UNIT 1:

Parallel system, distributed system, Parallel architecture, architectural classification schemes, Evolution of computer Architecture, system attributes to performance, multiprocessors and multi computers:-shared memory multiprocessors, models:- MA,NUMA,COMA ; Approximate performance of a multiprocessor, distributed memory multicomputers , Vector supercomputer, SIMD supercomputer, Program partitioning and scheduling, superscalar processor, Vector processors, GPU, massive parallel processors. Vector processing principles, multi vector multiprocessor, compound vector processing. Principle of multithreading, latency-hiding techniques, Network properties and routing, static connection network, dynamic connection network.

UNIT 2:

Arithematic mean performance, geometric performance, harmonic performance, Performance laws, Amdahl's law, gustafsons law, Sun and Ni' law, Bernstein's criteria, dependency analysis, flow dependency, anti dependency, output dependency, dependency flow graph, Evaluating parallel programs, Debugging and evaluating parallel program empirically.

UNIT 3:

Design and analysis of pipeline and system based on it, optimal no. of stages, Instruction scheduling, pipeline hazards and their solutions, Tomasulo algorithm, Branch predictions, pipeline and branch predictor of recent processors, Collision free scheduling, Reservation table and stations.

UNIT 4:

Design and analysis of parallel algorithms, Preliminaries, decomposition techniques, characteristics of tasks and interactions, mapping techniques for load balancing, methods for containing interaction overheads, parallel algorithm models, the task/channel model, Foster 's design methodology, boundary value problem, finding the maximum, n-body problem, sorting, searching, solving linear equations, matrix multiplication, Parallelizing sequential algorithms, SIMD algorithm for multiplication, PRAM and VLSI model

UNIT 5:

Parallel Programming, Cluster programming using MPI, Multi core programming using OPEN MP, Programming massive parallel processors using CUDA, GPU, OPENCL, OPENACC

Books:

- Michael J. Quinn, “Parallel Computing theory and practice”, TATA McGraw Hill
- Ananth Gramma, Anshul gupta, George Karypis & Vipin Kumar, “Introduction to parallel computing”, Pearson Education.
- Michael J. Quinn, “Parallel Programming in with MPI and OpenMP” , Pearson Education
- Barry Wilkinson & Michael Allen, “Parallel Programming techniques and Applications using networked work stations and parallel computers”, Pearson Education
- Kai Hwang, “Advanced Computer architectures, Parallelism, Scalability & Programmability”, McGraw Hill.
- John L. Hennessey and David A. Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
- David B. Kirk and Wen-mei W. Hwu, Programming Massive ly Parallel Processors, A hands on approach, Morgan Kaufman publishers,Elsevier.
- Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
- Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill,2003.
- 4. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors”,Morgan Kaufmann, 2010.
- Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, Second Edition, Pearson Education Limited, 2003.
- Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
- Ian Foster, “Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering”, Addison Wesley Longman Publishing Co., USA, 1995.
- David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A hardware/ Software approach” , Morgan Kaufmann / Elsevier Publishers, 1999.
- OpenMP Programmer’s Manual.
- MPI Programmer’s Manual

CEN- 701: DATA MINING

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students should be able to understand the data mining concepts and the various tasks related to data mining.
2. Students will be able to understand the preprocessing methods used to clean and prepare data for applying various data mining task.
3. Students should be able to understand the various association rule mining algorithms and should write programs to implement it.
4. Students should understand the various classification algorithms and should be able to use the datasets and apply the algorithms in order to classify it.
5. Students should understand the different clustering algorithms and should be able to apply these algorithms on real datasets. Students should be able to take research level problems related to data mining and should be able to implement it.

UNIT 1:

Introduction to Data Mining: KDD, Process and Data Mining; KDD Steps; Types of Data for Data Mining, Data Mining Functionalities: Data Characterization, Data Discrimination, Mining Frequent Patterns, Association, Correlation, Classification, Prediction, Cluster Analysis, Outlier Analysis, and Evolution Analysis; Classification of Data Mining Systems; Data Mining Task Primitives; Major Issues in Data Mining.

UNIT 2:

Data Preprocessing: Introduction to Data Preprocessing; Descriptive Data Summarization: Measuring and Central Tendency and Dispersion of Data; Visualization of Descriptive Data Summaries; Data Cleaning: Handling Missing Values, Filtering Noisy Data – Binning Method; Data Integration; Data Transformation: Smoothing, Aggregation, Generalization, Normalization and Feature Selection; Data Reduction; Data Discretization and Concept Hierarchy Generation.

UNIT 3:

Association Rule Mining: Market basket Analysis; Frequent Itemsets, Closed Itemsets, and Association Rules; Support and Confidence; Apriori Algorithm for Mining Frequent Itemsets Using Candidate Generation; Generating Association Rules from Frequent Itemsets; Improving the Efficiency of Apriori Algorithm; FP-Growth Algorithm for Mining Frequent Itemsets without Candidate Generation; Mining Closed & Max Frequent Itemsets; Correlation Analysis.

UNIT 4:

Classification Rule Mining: Introduction to Classification and Prediction; Classification by Decision Induction; Attribute Selection Measures: Information Gain, Gain Ratio, and Gini Index; Tree Pruning; Bayesian Classification: Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks; Classifier Accuracy Measures: Sensitivity, Specificity, Precision, and Accuracy; Predictor Error Measures; Accuracy Evaluation Methods: Holdout, Random Subsampling, Cross-validation, and Bootstrap; Accuracy Enhancement Methods:

Bagging and Boosting; Lazy Learners: K-Nearest- Neighbour Classifier; Prediction: Introduction to Linear and Non-Linear Regression.

UNIT 5:

Cluster Analysis: Introduction to Cluster and Clustering; Features Required for Clustering Algorithms; Data Types and Dissimilarity Measures in Cluster Analysis; Categorization of Clustering Methods; Partitioning-Based Clustering: k-means Algorithms, k-Medoids algorithms (PAM, CLARA, CLARANS); Hierarchical Clustering: Agglomerative and Divisive Methods (e.g.: AGNES, DIANA, BIRCH); Density-Based Clustering: DBSCAN, OPTICS, Outlier Analysis.

Introduction to Web Mining and Text mining. Problem discussion.

Recommended Books:

- Data Mining by Han and Kamber, Elsevier Publication.
- Introduction to Data Mining by Tan, Steinbach and Kumar, Pearson Publication.
- Practical Machine Learning Tools and Techniques with Java Implementations by H. Witten and E. Frank Morgan Kaufmann.
- Advances in Knowledge Discovery and Data Mining by U. M. Fayyad, G. Piatetsky-Shapiro, P. Smyth, and R. Uthurusamy, MIT Press.

CEN- 702: Mobile Communication

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Understand Principles and concepts, Mathematical model, Mobile generations, wireless frequencies.
2. Concepts used in Mobile Designing and frequency allocations.
3. Understand the calling system from Mobile to Mobile, Mobile to fixed line and vice-versa.
4. Understand the billing management and calling system while roaming in both GSM and CDMA.
5. Designing of Mobile systems and understanding about accessing of Internet using Mobile system.

UNIT-1

Introduction to Mobile and cellular Communication systems, Frequencies for radio communication, Basic cellular system, Transmission problems and its solution in cellular system, cellular geometry, components of a cellular Mobile network, cellular communication from 1G to 3G.

UNIT-2

Cellular Geometry, Concept of Frequency re-use channels, Cell splitting, Sectoring and Clustering of a cell, Co-channel interferences and system capacity, Trunking and Grade of services, Microcell zone concept.

UNIT-3

GSM Architecture, Channels used in GSM, Location tracking and call setup, Mobility management, Frame structure for GSM, Handover, Security in GSM, GSM call recording functions, Subscriber and service data Management, GSM network identities, Traffic cases in GSM.

UNIT-4

CDMA Architecture, Chipset sequence in CDMA, Channels used in CDMA, CDMA system design, capacity of a CDMA system, Next generation cellular technology 4G, 4G Softwares, Advantages of 4G Network technology over 3G, Applications of 4G.

UNIT-5

GPRS Architecture, Benefits of GPRS, GPRS attach and detach procedure, GPRS Traffic cases, Introduction to Wireless Application Protocol WAP, WAP Architecture, Applications of WAP, Introduction to Mobile IP.

Text Books

1. Theodore S. Rappaport, Wireless communications Principles and Practice, Pearson Education.
2. William C.Y. Lee, Wireless and cellular communications, McGraw Hill publication.

Reference Books

1. Jochen Schiller, Mobile Communications, Pearson Education 2012.
2. Vijay K. Garg, Wireless communication and Networking, Elsevier Morgan Kaufmann Publishers. Mobile Communication Hand Book", 2nd Edition, IEEE Press. 2002

CEN- 703: ARTIFICIAL INTELLIGENCE

L T P		Internal:	40 Marks
3 1 0		External:	60 Marks
Credits : 4		**Total:**	**100 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1. Students will be able to understand how to represent simple facts in Logic – Predicate logic, conversion into clause form, and Resolution etc.
2. Student will be able to understand informed and uninformed search Techniques A*, AO* Hill Climbing, Production system, Best first Search techniques etc.
3. Student will be able to understand fundamentals of AI, Machine Learning, Deep Learning, IoT, and Game playing: Minimax Search Procedure and Alpha Beta etc.
4. Student will be able to understand Learning, types of Learning, phases of NLP, Neural Network and its application etc.
5. Student will be able to understand strong and weak Slot and filler Structures, Hopfield network, Boltzmann Machine etc.

UNIT 1

Introduction to AI

What is Artificial Intelligence, AI problems, Task domain of AI, AI Technique, Scope and areas of application of AI, representing simple facts in logic- predicate logic, Conversion to clause form, Resolution and Natural Deduction.

UNIT-2

Problems, problem spaces and Search, Heuristic Search Techniques

Defining the problem as a state space search, Production system, problem characteristics, informed and uninformed search technique: Generate and Test, Hill Climbing, Best first search, A*, AO*, Means-ends, analysis, Approaches to Knowledge Representation.

UNIT-3

AI, Machine Learning, Deep Learning & Game playing

Fundamental of AI, Machine Learning, Deep Learning, Application of Machine Learning, IoT, and Game playing: Minimax Search Procedure and Alpha- Beta algorithm.

UNIT-4

Learning, NLP, Neural Network

What is learning?, Rote learning, learning by taking advice, learning in problem solving, leraning from examples: Induction, Phases of Natural Language Processing, Neural Network, , Learning in Neural Networks, Application of Neural Networks.

UNIT-5

Weak and strong slot- and – filler structures, Connectionist Models, Expert System.

Semantic Nets, Frames, Conceptual Dependency, Scripts & Reasoning: Forward versus Backward Reasoning, Monotonic Reasoning, Logics for Nonmonotonic Reasoning, Introduction to Hopfield Networks, Boltzmann Machine, Expert Systems: Characteristics, Architecture of Expert System, Some Major Applications of Expert System.

Books:

- Artificial Intelligence, 3RD Edition, E.Rich and K.Knight (TMH).
- Introduction to Artificial Intelligence – Rajendra Akerkar, PHI.
- Artificial Intelligence – A Modern Approach. Second Edition, Stuart Russel, Peter Norvig, PHI/Pearson Education.
- Artificial Intelligence, 3rd Edition, Patrick Henry Winston., Pearson Edition,
- Artificial Intelligence and Expert Systems – Patterson PHI
- Expert Systems: Principles and Programming- Fourth Edn, Giarrantana/ Riley, Thomson
- PROLOG Programming for Artificial Intelligence. Ivan Bratka- Third Edition – Pearson Education.

CEN- 704: PARALLEL AND DISTRIBUTED COMPUTING

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will be able to understand architecture , dependency analysis and other issues of parallel Systems and performance laws to evaluate them
2. Students will be able to design and implement pipeline for solving real life problems.
3. Students will able to design parallel algorithm for solving a given problem and to parallelize sequential algorithms.
4. Students will be able to understand and write cluster program using MPI, multi core program using Open Mp and programming massive parallel processor GPU using CUDA.
5. Students will able to develop real life scalable distributed system and distributed applications

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UNIT 1:

Parallel system , Parallel computing, architectural classification schemes, Evolution of computer Architecture ,Parallel architecture, superscalar processor, Vector processors, Principle of multithreading, latency-hiding techniques, multi core processors, GPU, massive parallel processors, Cache coherence and synchronization mechanism , Arithmetic mean performance, geometric performance, harmonic performance, Performance laws, Amdahl's law, Gustafson's law, Sun and Ni' law, Bernstein's criteria, dependency analysis, flow dependency, anti dependency, output dependency, dependency flow graph, Evaluating parallel programs, Debugging and evaluating parallel program empirically.

UNIT 2:

Pipeline, Design and analysis of pipeline and system based on it, optimal no. of stages, Instruction scheduling, pipeline hazards and their solutions, Tomasulo algorithm, Branch predictions, pipeline and branch predictor of recent processors, Collision free scheduling, Reservation table and stations.

UNIT 3:

Design and analysis of parallel algorithms, Preliminaries, decomposition techniques, characteristics of tasks and interactions, mapping techniques for load balancing, methods for containing interaction overheads, parallel algorithm models, the task/channel model, Foster 's design methodology, boundary value problem, finding the maximum, n-body problem, sorting, searching, solving linear equations, matrix multiplication, Parallelizing sequential algorithms, SIMD algorithm for multiplication, PRAM and VLSI model

UNIT 4:

Parallel Programming, Cluster programming using MPI, Multi core programming using OPEN MP, Programming massive parallel processors using CUDA, GPU, OPENCL, OPENACC

UNIT 5:

Distributed system, distributed computing, distributed applications, paradigms of Distributed Computing, Cloud Computing, Distributed algorithms, Logical clocks, clock synchronization algorithms

Books:

- Michael J. Quinn, “Parallel Computing theory and practice”, TATA McGraw Hill
- Ananth Gramma, Anshul gupta, George Karypis & Vipin Kumar, “Introduction to parallel computing”, Pearson Education.
- Michael J. Quinn, “Parallel Programming in with MPI and OpenMP” , Pearson Education
- Barry Wilkinson & Michael Allen, “Parallel Programming techniques and Applications using networked work stations and parallel computers”, Pearson Education
- Kai Hwang, “Advanced Computer architectures, Parallelism, Scalability & Programmability”, McGraw Hill.
- John L. Hennessey and David A. Patterson, “Computer Architecture – A quantitative approach”, Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
- David B. Kirk and Wen-mei W. Hwu, Programming Massively Parallel Processors, A hands on approach, Morgan Kaufman publishers,Elsevier.
- Peter S. Pacheco, “An Introduction to Parallel Programming”, Morgan Kaufmann, 2011.
- Michael J Quinn, “Parallel programming in C with MPI and OpenMP”, Tata McGraw Hill,2003.
- 4. David B. Kirk and Wen-mei W. Hwu, “Programming Massively Parallel Processors”,Morgan Kaufmann, 2010.
- Ananth Grama, George Karypis, Vipin Kumar and Anshul Gupta, “Introduction to Parallel Computing”, Second Edition, Pearson Education Limited, 2003.
- Shameem Akhter and Jason Roberts, “Multi-core Programming”, Intel Press, 2006.
- Ian Foster, “Designing and Building Parallel Programs: Concepts and Tools for Parallel Software Engineering”, Addison Wesley Longman Publishing Co., USA, 1995.
- David E. Culler, Jaswinder Pal Singh, “Parallel Computing Architecture: A hardware/ Software approach” , Morgan Kaufmann / Elsevier Publishers, 1999.
- OpenMP Programmer’s Manual.
- MPI Programmer’s Manual
- Kai Hwang, Distributed and Cloud Computing, Elsevier
- Raj kumar Buya , Mastering Cloud Computing, TMH publications.

CEN- 706: COMPUTER GRAPHICS

L T P		Internal:	40 Marks
3 1 0		External:	60 Marks
Credits : 4		**Total:**	**100 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1. Student will be able to understand comprehensive introduction about computer graphics system, design algorithms.
2. Student will be able to Critically understand the theory of 2D and 3D transformations, projection and viewing
3. Student will be Able to find & combine relevant sources and synthesize designs.
4. Students will be familiar with techniques of clipping, three dimensional graphics and three dimensional transformations.
5. Student will be prepared for activities involving in design, development and testing of modeling, rendering, shading and animation.

UNIT 1:

Introduction Computer Graphics and Primitive Algorithms: Introduction to Image and Objects, Image Representation, Basic Graphics Pipeline, Bitmap and Vector-Based Graphics, Applications of Computer Graphics, Display Devices, Cathode Ray Tubes, Raster Scan Display, Random-Scan Display, Flat Panel Display, Input Technology, Coordinate System Overview, Scan-Conversion of graphics primitives: Scan-Conversion of a Lines (Digital Differential Analyzer Algorithm, Bresenham's Line Drawing Algorithm, Scan Conversion of Circle and Ellipse, Bresenham's Method of Circle Drawing, Midpoint Circle Algorithm, Drawing Ellipses and other Conics

UNIT 2:

Basic raster graphical algorithm for 2D primitives, Transformation: Translation, Rotation, Scaling, Mirror Images, Coordinate system, 3DTransformation, Rotation about an arbitrary axis, Orthogonal Projections, Multiple Views, Isometric Projection, Perspective Projections (one ,two and three vanishing points), Wire Frame Perspective, 3D transformation.

UNIT 3:

Window, View port, clipping algorithms, Curves and Surfaces: Circle drawing algorithm, Ellipse drawing algorithm, Bezier curve, B-spline curve, surfaces, Solid modelling. Parallel projection, Perspective projection, Computation of vanishing point, visible surface determination: Z-buffer algorithm, Scan line algorithm, Area subdivision algorithm, Ray tracing algorithm, Painter’s Algorithm.

UNIT 4:

Illumination mode, Specular reflection model, Shading models for curve surfaces, Rendering, Recursive ray tracing, Texture mapping Advanced Modelling Techniques Procedural Models, Fractal Models, Grammar based models, particle systems.

UNIT 5:

Object Rendering, Introduction Object-Rendering, Light Modeling Techniques, illumination Model, Shading, Flat Shading, Polygon Mesh Shading, Gouraud Shading Model, Phong Shading, Transparency Effect, Shadows, Texture and Object Representation, Ray Tracing, Ray Casting, Color Models. Introduction to animation, Key-Frame Animation.

Books:

- Hearn & Baker - Computer Graphics C version, 2nd ed. Pearson Education.
- Roger and Adams - Mathematical Element for Computer Graphics, 2nd ed., Tata McGraw Hill.
- Schaum's Outline of Computer Graphics by Roy Plastock and Zhigang Xiang, 2nd Edition McGraw Hill
- Foley - Computer Graphics Principles & Practice, 2nd ed. Pearson Education.
- David F. Rogers, “Procedural Element for computer graphics”, McGraw Hill.

CEN- 801: SOFTWARE PROJECT MANAGEMENT

L	T	P		Internal:	40 Marks
3	1	0		External:	60 Marks
Credits : 4				**Total:**	**100 Marks**
Duration of Exam : 3 Hours					

Course Outcomes:

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1. Students will be able to learn about phases of projects starting from conceptualization to completing or commissioning the project, including tools that are used to monitor, control and progress the projects.
2. Students will be able to understand the purpose of project planning, identify the scope of the project, estimate the work involved, and create a project schedule.
3. Students will learn about different techniques of project management.
4. Students will gain clear understanding of software quality assurance techniques.
5. Students will learn how to track project performance using project management activities.

UNIT 1: INTRODUCTION TO PROJECT MANAGEMENT

Project Management Concepts; define the characteristics of a project. Explain the need for project management. Compare and contrast the roles of project managers in organizational environments. Describe the systems development cycle. Explain the roles of systems analysis and systems management in the life cycle of a project.

UNIT 2: SOFTWARE PROJECT PLANNING

Project Activities, and work breakdown structure, Produce a statement of work (SOW) and decompose overall project goals. Develop a work breakdown structure (WBS), using established tools and techniques, to achieve stated project objectives.

UNIT 3: PROJECT MANAGEMENT PLAN

Project Scheduling and tracking techniques, Produce a task-flow network, using established tools and techniques, and analyze the contingencies, interrelationships, and critical path(s) of the work elements. Produce a Gantt chart, using established tools and techniques, to schedule the completion of all work elements.

UNIT 4: PROJECT ECONOMICS

Project costing, project estimation techniques, automated estimation tools. Develop cost estimates and budgets with cost accounts to plan project expenditures.

UNIT 5: PROJECT CONTROL AND CLOSURE

Define the concept of earned value performance measurement. Describe how project management information systems (PMIS) are used to monitor, evaluate, and control planned cost and schedule performance. Project management issues with regards to new technologies.

Books:

- Mathur, S.S. Principles of Management”
- Robbin. S.P., “Organisational Behaviour”
- Prof: KK Aggarwal & Yogesh Singh: SOFTWARE ENGG:
- Pankaj Jalote, “ An Integrated Approach to Software Engg” Narosa Publishing House, New Delhi.
- Pressman”Priciples of Software Engg” TMC, 5th Ed. 2005

CEN- 805: NETWORK SECURITY

L	T	P	Internal:	40 Marks
3	1	0	External:	60 Marks
Credits : 4			**Total:**	**100Marks**
Duration of Exam : 3 Hours				

Course Outcomes:

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1. Understand Principles and concepts, security concepts, Ethics in Network Security, security services and mechanisms to counter them.
2. Concepts in Number theory and other related Mathematics used in Network Security.
3. Encrypt and decrypt messages using block ciphers and Stream Ciphers.
4. Comprehend and apply relevant cryptographic symmetrical and asymmetrical techniques.
5. Sign and verify messages using well known Digital signature generation and verification algorithms required for digital Identity.

UNIT 1: Introduction:

Modular Arithmetic, Linear congruence, Primality testing, Factorization, Chinese Remainder Theorem, Quadratic congruence, Fermat's Theorem, Euler's Theorem, Galois Field, Euclidean and Extended Algorithm, Diophantine equation. Exponentiation and logarithm, Need for network security, Security approaches, Principles of security, Types of Attacks, Services and Mechanisms.

UNIT-2 Private and Public key Cryptography:

Block Encryption, Symmetrical key cryptography: DES rounds, S-Boxes, IDEA: Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography, Advance Encryption Standard AES. Public key cryptography: Knapsack, RSA: keys generating, encryption and decryption. El-Gamal, Elliptical curve cryptography, use of public key cryptography Digital signature, DSS, Zero-knowledge signatures.

UNIT-3 Hash Functions and Message Digests:

Message Digest algorithms: Length of HASH, uses, Message Digest 4 and 5: algorithm (padding, stages, and digest computation.) SHA1 and SHA512: Overview, padding, stages. Message Authentication Codes (MACs).

UNIT-4 Access control, Authentication and Authorization

Authentication Methods, Passwords, Single sign on, Entity Authentication, Authentication Protocol, Kerberos: purpose, authentication, serer and ticket granting server, keys and tickets, use of AS and TGS, replicated servers. Kerberos V4: names, inter-realm authentication, Key version numbers, KDC's Certification Revocation, Inter domain, groups, delegation. Authentication of People: Verification techniques, passwords, length of passwords, password distribution.

UNIT-5 Internet security:

Electronic mail security, IP security, Network management security. Security for electronic commerce: Secure Socket Layer. Secure Electronic Transaction, Pretty Good Privacy, IP Security, Intruders and Viruses, Firewalls, Intrusion Detection system.

Text Book

1. Stallings, W., Cryptography and Network Security: Principles and Practice, 6th ed., Prentice Hall Print.,2003
2. Behrouz A Forouzan, Cryptography and Network Security, 3rd Edition 2016, McGraw Hill.

Reference Books

1. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall Print, 2002.
2. Atul Kahate, Cryptography and Network Security, McGraw Hill.

CEN- 806: SOFT COMPUTING TECHNIQUES

L	T	P		
3	1	0	Internal:	40 Marks
			External:	60 Marks

Credits : 4 **Total: 100 Marks**

Duration of Exam : 3 Hours

Course Outcomes:

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1. Students will know the basics of soft computing techniques, their strengths and relations.
2. Students will be able to get the concept of artificial neural network as computation and learning tool along with its applications areas.
3. Students will be able to understand the basics of fuzzy set theory, fuzzy relations, fuzzy logic, etc, and significances.
4. Students will be able to have an idea of defuzzifications, operations of mutation, crossover and genetic algorithm for optimization problems.

UNIT I: INTRODUCTION

Introduction to Soft Computing, various types of soft computing techniques: Neural Networks, Fuzzy Logic, Genetic algorithm, Probabilistic reasoning and Approximation. Intelligent systems, Machine Intelligence, Applications of Soft computing.

UNIT II: ARTIFICIAL NEURAL NETWORKS (ANN)

Function of Neuron, Biological Neuron, Artificial Neuron, Brain vs Computer, Neural Network architectures and characteristics, Basic Model of ANN: connections, weights, bias, activation functions. McCulloch-Pitts Neuron, Hebb Training algorithm, Linear separability, XOR problem.

UNIT III: ANN LEARNING

ANN Learning, Learning Rules, Supervised learning: Perceptron, Multi-layer perceptron, ADALINE, MADALINE, Back-Propogation network. Unsupervised learning: Kohonen Self-organizing feature map, Learning vector quantization. Special Networks: Hopfield network, Recurrent network, Cellular Neural Network, Applications of ANN.

UNIT IV: FUZZY LOGIC

Introduction to Fuzzy logic, Fuzzy set theory, Fuzzy set vs Crisp set, Fuzzy relation & Crisp relation, Fuzzy logic operations, Tolerance & Equivalence relations, Membership functions, Features of membership functions, Membership value assignment, Basics of Fuzzy arithmetic.

UNIT V: FUZZY MODELS & GENETIC ALGORITHM

Fuzzification, Defuzzification, Fuzzy rules, Fuzzy If-Then rule, Fuzzy rule base system, Fuzzy inference system: Models of FIS. Applications of Fuzzy logic. Introduction to Genetic algorithm: working principle, encoding, fitness function, reproduction, Inheritance, cross-over. Applications of Genetic algorithm.

BOOKs:

1. F O Karray and C De Silva, “Soft Computing & Intelligent Systems Design”, Pearson, 2009.
2. Timothy J Ross, “Fuzzy Logic with Engineering Applications”, Wiley, 2011.
3. Rajasekaran & Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications”, PHI, 2011.
4. J J S Roger, S Chuen-Tsai, E Mizutani, “Neuro-Fuzzy and Soft Computing”, PHI.
5. David E Goldberg, “Genetic Algorithm in Search, Optimization & Machine Learning”, Pearson, 2011.
6. S Haykin, “Neural Networks: A Comprehensive Foundations” Pearson,

CEN - 807: Natural Language Processing and Information Extraction

L T P		Internal:	40 Marks
3 1 0		External:	60 Marks
Credits : 4		**Total:**	**100 Marks**
Duration of Exam : 3 Hours			

Course Outcomes:

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1. Students will be able to implement text processing tasks and develop probabilistic language models.
2. Students will be able to implement text classification and sequence modelling on various problems.
3. Students will be able to implement lexical semantics tasks: word similarity and word sense disambiguation.
4. Students will be able to understand distributional semantics, word embeddings and neural language models.
5. Students will be able to implement information extraction tasks: named entity recognition and relation extraction.

Unit 1. Text Processing Tasks and Probabilistic Language Models
Introduction to Text, Speech and Language Technologies, Basic Text Processing Tasks, Normalization, Max Match Algorithm, Lemmatization, Porter Stemmer, Minimum Edit Distance, Probabilistic Language Models: N Grams, Bigram Probabilities, Perplexity, Smoothing Techniques: La Place, Good Turing, Kneser Ney, Interpolation.

Unit 2. Text Classification and Sequence Modelling
Text Classification: Bag of words, Conditional Independence, Multinomial Naïve Bayes Classifier, Maximum Likelihood Estimation, Evaluation of Text Classification Model. Sentiment Analysis: Entity based and aspect Based Feature Extraction, Baseline Algorithm, Sentiment Lexicons, Polarity Analysis. Building Sentiment Lexicons: Semi supervised Algorithm, Turney Algorithm. Sequence Modelling: Markov Models, HMM, Beam, Greedy and Viterbi inference, HMM, CRF, LSTM based POS tagging.

Unit 3. Lexical Semantics
Word Senses and Word Relations, Wordnet. Computing Word Similarities: Path Based, Information Content, Word Sense Disambiguation, Thesaurus based WSD using Wordnet, Lesk Algorithm, Typical Features of WSD, Supervised WSD, Semi supervised WSD.

Unit 4. Distributional Semantics
Vector Semantics: Distributed Representations, Word Context Matrix Generation, Weighting Methods, Dimensionality Reduction, Similarity Measures. Word Embeddings, Learning of Neural Embeddings.

Unit 5. Information Extraction
Named Entity Recognition: Hand Written Regular Expressions, Typical Features for NER, Classification models, Sequence Models. Relation Extraction: Binary Relation Association, Relation Extraction from Wikipedia, Supervised Relation Extraction, Semi-supervised Relation Extraction, Distant Supervision.

Books:

- Daniel Jurafsky and James H. Martin, “Speech and Language Processing”, 2nd Edition, Pearson Education, 2013.
- Yoav Goldberg, “Neural Network Methods in Natural Language Processing”, Morgan & Claypool Publishers, 2017.
- Steven Bird, Ewan Klein, Edward Loper “Natural Language Processing with Python”, O′Reilly, 2009.
- Manning and Schuetze, “Foundations of Statistical Natural Language Processing”, MIT Press, 1999.