

Bachelor of Technology (Computer Science & Engineering)										
Credit-Based Scheme of Studies/Examination										
Semester V(w.e.f. session 2020-2021)										
S. No.	Course Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hrs)
						Major Test	Minor Test	Practical	Total	
1	ES-301A	Microprocessor & Interfacing	3:0:0	3	3	75	25	0	100	3
2	PC-CS-301A	Database Management Systems	3:0:0	3	3	75	25	0	100	3
3	PC-CS-303A	Formal Language & Automata Theory	3:0:0	3	3	75	25	0	100	3
4	PC-CS-305A	Essential of Information Technology	3:0:0	3	3	75	25	0	100	3
5	PC-CS-307A	Computer Organization & Architecture	2:0:0	2	2	75	25	0	100	3
6	PEC	Elective-I	3:0:0	3	3	75	25	0	100	3
7	PC-CS-309LA	Database Management Systems Lab	0:0:4	4	2	0	40	60	100	3
8	PC-CS-311LA	Essential of Information Technology Lab	0:0:4	4	2	0	40	60	100	3
Total				25	21	450	230	120	800	
9	MC-904A	Energy Resources & Management	3:0:0	3	0	0	100	0	100	3
10	SIM-301A*	Seminar on Summer Internship	2:0:0	2	0	0	50	0	50	

PEC Elective-I

Digital Data Communication: PE-CS-T301A

Parallel and Distributed Computing: PE-CS-T303A

Information Theory and Coding: PE-CS-T305A

Advanced Algorithms: PE-CS-T307A

***Note:** SIM-301*is a mandatory credit-less course in which the students will be evaluated for the Summer Internship undergone after 4th semester and students will be required to get passing marks to qualify.

ES-301A	Microprocessor & Interfacing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To learn the architecture and programming of Intel family microprocessors and its interfacing.						
Course Outcomes							
CO 1	To study the Architecture of 8086 microprocessors						
CO 2	To implement the interfacing of memories to 8086 Microprocessor						
CO 3	To learn and analyze the instruction set of 8086 Microprocessor and implementation of assembly language programming of 8086 Microprocessor.						
CO 4	To design and implement the interfacing of interrupts, basic I/O and DMA with 8086 Microprocessor						

Unit I

8086 CPU ARCHITECTURE: 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

UNIT-II

Main Memory System Design: Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS/PROMS. Interfacing and refreshing DRAMS.

UNIT-III

8086 Instruction Set: Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives.

8086 Programming Techniques: Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions.

UNIT-IV

Basic I/O Interface: Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086. ADCs and DACs, - types, operation and interfacing with 8086. Interfacing Keyboards, alphanumeric displays, multiplexed displays, and stepper motor, optical encoder with 8086.

Interrupts and DMA: 8086 Interrupt mechanism; interrupt types and interrupt vector table. Applications of interrupts, Intel's 8259. DMA operation. Intel's 8237.

Suggested Books:

1. Barry B. Brey, "The Intel Microprocessor 8086/8088, 80186", Pearson Education, Eighth Edition, 2009
2. D.V. Hall, Microprocessors and Interfacing, McGraw Hill 2nd ed.
3. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI, 2005
4. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Cengage Learning, Indian Edition, 2008
5. Kip Irvine, "Assembly language for IBM PC", PHI, 2nd Edition, 1993
6. Peter Abel, "Assembly language programming", Pearson Edu, 5th Edition, 2002
7. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.
8. Walter A Triebel and Avtar Singh; The 8088 and 8086 Microprocessors

PC-CS-301A	Database Management Systems						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To familiarize the students with Data Base Management system						
Course Outcomes							
CO 1	To provide introduction to relational model and ER diagrams.						
CO 2	To realize about Query Processing and Transaction Processing.						
CO 3	To comprehend about the concept of functional dependencies.						
CO 4	To learn the concept of failure recovery and concurrency control.						

UNIT I

Introduction: Concept & Overview of DBMS, Data Models-, Network, Hierarchical and Relational Model, Levels of abstraction. Administrator, Database Users, Three Schema architecture of DBMS, Application.
Entity-Relationship Model: : Entities, Attributes and Entity Sets, Relation and Relationships sets, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.

UNIT II

Relational Model: Structure of relational Databases, Relational Algebra and Relational Calculus, Operations on Relational Algebra, Operations on Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus.
SQL and Integrity Constraints: Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, Introduction to views, Querying, Nested Sub queries, Database security application development using SQL, Stored procedures and triggers.

UNIT III

Relational Database Design:

Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF.

Internals of RDBMS: Physical data structures, Query optimization: join algorithm, statistics and cost base optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.

UNIT IV

Recovery System: Types of Failures, Recovery Techniques, ARIES.

Concurrency Control: Serial and Serializable Schedules-Conflict Serializability –Enforcing Serializability by Locks-Locking Systems with Several Lock Modes-Concurrency Control by Timestamps, validation.

Transaction Management: ACID Properties, Transaction states, Serializability and Recoverability-View, Serializability-Resolving Deadlocks-Distributed Databases: Commit and Lock

Suggested Books:

- RamezElmasri,ShamkantB.Navathe,"Fundamentals of Database systems", Pearson
- Korth, Silberschatz, Sudarshan: database concepts, MGH,
- R. Ramakrishnan and J. Gehrks database management system; MGH, International edition,
- C. J. Date, data base systems: 7th edition, Addison Wesley, Pearson Education,
- Chakrabarti, Advance database management systems , Wiley Dreamtech

PC-CS-303A	Formal Language & Automata Theory						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hour
Purpose	To understand the challenges for Theoretical Computer Science and its contribution to other sciences						
Course Outcomes							
CO 1	Students are able to explain and manipulate the different fundamental concepts in automata theory and formal languages.						
CO 2	Simplify automata and context-free grammars; Prove properties of languages, grammars and automata with rigorously formal mathematical methods, minimization.						
CO 3	Differentiate and manipulate formal descriptions of push down automata, its applications and transducer machines.						
CO 4	To understand basic properties of Turing machines and computing with Turing machine, the concepts of tractability and decidability.						

Unit - I

Introduction to Automata: Study and Central Concepts of Automata Theory, Applications of Finite Automata, An Introduction of Deterministic Finite Automata(DFA) and Non-Deterministic Finite Automata(NFA), Finite Automata with Epsilon (ϵ) Transitions.

Regular Expression and Languages: Regular Expressions (RE), Finite Automata and Regular Expressions, Applications of Regular Expressions, Algebraic Laws of Regular Expressions, Closure Properties of Regular Languages, RE to NFA, DFA Conversion and DFA to RE, Equivalence and Minimization of NFA and DFA automata.

Unit-II

Context free Grammars and Languages: Parse Trees, Context Sensitive Grammar, Context Free Grammar, Regular Grammar, Applications of Context Free Grammars, Ambiguity in Grammars and Languages. Closure Properties of CFL, Chomsky Theorem, Chomsky Hierarchy, Normal forms of context free grammars: Chomsky Normal Form, Greibach Normal Form.

Pumping Lemma: Introduction to Pumping Lemma, pumping lemma for context free languages, Applications of Pumping Lemma, Minimization of Finite Automata, and Recursive Language.

Unit-III

Mealey and Moore Machines: Definitions, Representation, Equivalence of Moore and Mealey Machines and its Designing.

Push Down Automata: Introduction of Push Down Automata (PDA), Language of PDA, Equivalence of PDA's and CFG's, Deterministic Push Down Automata, Designing of PDA, Applications of PDA.

Unit-IV

Introduction to Turing Machine: The Turing Machine, Programming Techniques for Turing Machine, Extensions of Turing Machine, Restricted Turing Machines, Universal Turing Machines and Designing of Turing Machines, Time and Tape Complexity Measures of Turing machines

Decidability: Post's Correspondence Problem (PCP), Rice's Theorem, Decidability and Undecidability properties, P-NP class and completeness.

Suggested Books:

- J.E.Hopcroft, R.Motwani and J.D.Ullman , "Introduction to Automata Theory Languages and computation", Pearson Education Asia , 2001.
- K.Krithivasan and R.Rama; Introduction to Formal Languages, Automata Theory and Computation; Pearson Education, 2009.
- Peter Linz, "An Introduction to Formal Language and Automata", 4th Edition, Narosa Publishing house , 2006.
- M.Sipser; Introduction to the Theory of Computation; Singapore: Brooks/Cole, Thomson Learning, 1997.
- John.C.martin, "Introduction to the Languages and the Theory of Computation", Third edition, Tata McGrawHill, 2003

PC-CS-305A	Essential of Information Technology						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To introduce the concepts of Advanced Java Programming						
Course Outcomes (CO)							
CO1	Study fundamental concepts of Java.						
CO2	Design of user interfaces using Java applets.						
CO3	To study and implement JDBC and Jbeans.						
CO4	To study concepts of servlets and its applications.						

UNIT-I

Introduction: Importance and features of Java, Concepts of Java Virtual machine (JVM), Keywords, Constants, Variables and data types, operators and expressions, Control statements, Conditional statements, loops and iterations. Class definition, adding variables and methods, creating objects, constructors, defining methods, calling methods, method overloading. Creating an array, one and two dimensional array, string array and methods String and String Buffer classes, Wrapper classes. Packages and Interfaces, exception handling.

UNIT-II

Design of User Interfaces: Swing, Applet, Icons and Labels, Text Fields, Buttons, button Class, Check Box, Radio Buttons, The Container, Panel, Windows, and Frame Classes, Combo Box, Tabbed Panes, Scroll Panes, Trees, Tables.

UNIT-III

Servlets: Introduction to Servlets, Life cycle of Servlets, Creating, Compiling and running servlet, Reading the servlet Parameters, Reading Initialization parameter, Packages- javax.servlet Package, Handling HTTP Request and Response (GET / POST Request), Cookies and Session Tracking.

UNIT-IV

Advance Java: Collection, list, Map, Tree, Hashing.

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL statements, working with Result Set Object & Result Set Meta Data.

Suggested Books:

1. Gary Cornell and Horstmann Cay S., Core Java, Vol I and Vol II, Sun Microsystems Press.
2. Herbert Schildt, Java: The Complete Reference, McGraw-Hill.
3. Philip Hanna, JSP: The Complete Reference, McGraw-Hill.
4. Deital and Deital, Java How to Program, Prentice Hall (2007).

PC-CS-307A	Computer Organization & Architecture						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	0	2	75	25	100	3 Hrs.
Purpose	Student will be able to understand the basic concepts of computer architecture and organization, and understand the key skills of constructing cost-effective computer systems.						
Course Outcomes (CO)							
CO1	Be familiar with the internal organization and operations of a computer.						
CO2	Be familiar with the design trade-offs in designing and constructing a computer processor.						
CO3	Be aware with the CPU design including the RISC/CISC architectures.						
CO4	Be acquainted with the basic knowledge of I/O devices and Select the appropriate interfacing standards for I/O devices.						

Unit- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, Von Neumann Architecture, evolution and computer generations; Fixed point representation of numbers, digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm and Division using restoring and non restoring algorithms. Floating point representation with IEEE standards and its arithmetic operations.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

Unit-II

Basic Computer organization and Design: Instruction codes, stored program organization, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: configuration, instructions, Program interrupt, Interrupt cycle, Micro programmed Control s organization, Control Memory, address sequencing, Micro program Example, micro instruction format, Horizontal Vs Vertical micro-programming, design of control Unit, microprogram sequencer, Hardwired v/s Micro-programmed Control Unit.

Unit-III

Central Processing Unit: General register organization, stack organization, instruction formats (Zero, One, Two and Three Address Instruction), addressing modes, Data transfer and manipulation, Program control. CISC and RISC: features and comparison. Pipeline and vector Processing , Parallel Processing, Flynn's taxonomy, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

Unit-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor , CPU-IOP communication, Serial communication.

Suggested Books:

- William Stallings, "Computer Organization and Architecture – Designing for Performance", Sixth Edition, Pearson Education, 2003.
- Morris Mano, M., "Computer System Architecture," 3/e, Pearson Education, 2005.
- John P. Hayes, "Computer Architecture and Organization," 3/e, TMH, 1998.
- David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Third Edition, Elsevier, 2005.
- V.P. Heuring, H.F. Jordan, "Computer Systems Design and Architecture", Second Edition, Pearson Education, 2004.
- Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw Hill, 2002.

PC-CS-309LA	Database Management Systems Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2	40	60	100	3 Hours
Purpose	To familiarize the students with the basics of Data base management system.						
Course Outcomes							
CO1	To understand basic DDL commands						
CO 2	To learn about DML and DCL commands						
CO 3	To understand the SQL queries using SQL operators						
CO 4	To understand the concept of relational algebra						
CO5	To learn various queries using date and group functions						
CO6	To understand the nested queries						
CO7	To learn view, cursors and triggers.						

1. Write the queries for Data Definition Language (DDL) in RDBMS.
2. Write the queries for Data Manipulation Language (DML) in RDBMS.
3. Write the queries for Data Control Language (DCL) in RDBMS.
4. To perform various integrity constraints on relational database.
5. Create a database and perform the following operations:-
 - a. Arithmetic and Relational operations
 - b. Group by & having clauses
 - c. Like predicate for pattern matching in database
6. Write SQL queries for relational algebra
7. Write SQL queries for extracting data from more than one table
8. Write SQL queries for sub queries, nested queries
9. Concepts for ROLL BACK, COMMIT & CHECK POINTS
10. Using two tables create a view, which shall perform natural join, equi join, outer joins.
11. Write a procedure for computing income tax of employee on the basic of following conditions:-
 - a. if gross pay $\leq$ 40,000 then I.T rate is 0%.
 - b. if gross pay $>$ 40,000 but $<$ 60000 then I.T rate is 10%.
 - c. if gross pay $>$ 60,000 but $<$ 1,00,0000 then I.T rate is 20%.
 - d. if gross pay $>$ 1,00,0000 then I.T rate is 30%.

For this purpose create a table with name, ssn, gross salary and income tax of the employee.
12. Write trigger for before and after insertion, deletion and updation process.

PC-CS-311LA	Essential of Information Technology Lab						
Lecture	Tutorial	Practical	Credit	Minor Test	Practical	Total	Time
0	0	4	2	40	60	100	3 Hrs.
Purpose	To introduce the concepts of Advanced Java Programming						
Course Outcomes (CO)							
CO1	Study fundamental concepts of Java.						
CO2	Design of user interfaces using Java applets.						
CO3	To study and implement JDBC and Jbeans.						
CO4	To study concepts of servlets and its applications.						

1. Write a Java Package with Stack and queue classes.
2. Design a class for Complex numbers in Java .In addition to methods for basic operations on complex numbers, provide a method to return the number of active objects created.
3. Develop with suitable hierarchy, class for point, shape rectangle, square, circle, ellipse, triangle, polygenetic.
4. Design a simple test application to demonstrate dynamic polymorphism.
5. Design a java interface for ADT Stack.
6. Develop two different classes that implement this interface. One using array and other using linked list.
7. Develop a simple paint like program that can draw basic graphical primitives
8. Develop a scientific calculator using event driven programming.
9. Develop a template for linked list class along with its members in Java.
10. Write a program to insert and view data using Servlets

PE-CS-T301A	Digital Data Communication						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3
Purpose	To provide the conceptual knowledge of data preparation and signal transmission methodologies used in data communication and networking.						
Course Outcomes							
CO 1	To study various analog communication techniques and with their characteristics.						
CO 2	To study and understand the requirements for analog/digital data to analog/digital signal conversion techniques.						
CO 3	To study the error and flow control techniques in communication and networking.						
CO 4	To study the concept of multiplexing and applied multiple access techniques specially in satellite communication.						

UNIT-1

MODULATION TECHNIQUES

Basic constituents of Communication Systems need of modulation, Amplitude modulation, spectrum of AM wave, modulation index, DSBSC modulation, SSB Modulation, vestigial side band modulation.

ANGLE MODULATION: Frequency and Phase Modulation, spectrum of FM Wave, Modulation Index and Bandwidth of FM Signal, NBFM and WBFM.

UNIT-II

DATA ENCODING

Digital data, Digital signals: Encoding schemes: NRZ-L, NRZ-I, Manchester-Diff-Manchester-encoding, Pseudoternary-Bipolar-AMI, B8ZS- HDB3 – Evaluation factors-Digital data, analog signals: Encoding Techniques –ASK-FSK-PSK-QPSK-Performance comparison-Analog data, digital signals: Quantization- Sampling theorem-PCM-Delta modulation-Errors- comparison- Analog Data, analog signals: Need for modulation -0 Modulation methods – Amplitude modulation- Angle modulation- Comparison.

UNIT-III

DIGITAL DATA COMMUNICATION TECHNIQUES

Asynchronous and synchronous transmission –Error Detection techniques: Parity checks – Cycle redundancy checks-Checksum-Error Correcting codes: Forwards and backward error corrections, Transmission media. Communication Topologies.

DTE & DCE interface: Characteristics of DTE-DCE interface. Interfaces: Rs-232-C, Rs-449/422, A/423-A.

UNIT-IV

SATELITE COMMUNICATION

Multiplexing: Advantages, Types of Multiplexing: FDM, Synchronous TDM, Statistical TDM/Asynchronous TDM, Study of their characteristics.

Satellite Communication Systems: Satellite parameters and configurations – Capacity allocation, Frequency Division FDMA; Time Division TDMA- Fixed assigned multiple access (FAMA), Demand assign multiple access (DAMA) – The concept of spread spectrum: FHSS, DSSS – CDMA – Transmission and reception.

Suggested Books

1. Forouzen, "Data Communication & Networking", TataMcgraw Hill
2. Proakin, "Digital Communications", McGraw Hill.
3. W. Stallings, "Wireless Communication and Networks" Pearson.
4. Stallings, "Data & computer Communications", PHI.
5. Roden, "Digital & Data Communication Systems", PHI.
6. Irvine, Data communications & Networks An engineering approach, wileyindia

PE-CS-T303A	Parallel and Distributed Computing						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To enable students to evaluate various architectural taxonomies, design paradigms, parallelism approaches, performance measures, parallel programming models and case studies, scheduling and parallel architecture and their programming constructs.						
Course Outcomes (CO)							
CO1	Classify various synchronous and asynchronous paradigms of parallel and distributed computing as well as identify some of the taxonomies and parallel algorithms.						
CO2	Evaluate various parallel computation models and approaches and analyze different performance metrics for parallel and distributed computing.						
CO3	Analyze the importance of pipelining and superscalar techniques, parallel programming models and case studies of parallel processors.						
CO4	Examine various techniques of parallelizing loops, sequential programs and scheduling and parallel architecture for cognitive functions.						

Unit-I

Introduction: The state of computing, system attributes to performance, multiprocessors and multicomputer, multivector and SIMD computers, basics of parallel programming models, parallel algorithms and distributed processing, Conditions of parallelism: Data, control and resource dependencies, Hardware and software parallelism. Hardware Taxonomy: Flynn's classification, Shore's classification, Feng's classification, Handler's classification. Software taxonomy: Kung's taxonomy.

Unit-II

Abstract parallel computational models: combinational circuits, sorting network, PRAM models, VLSI complexity model, architecture development tracks, program partitioning and scheduling, program flow mechanisms. Performance metrics and measures: parallelism profile in programs, mean performance, efficiency, utilization and quality, benchmarks and performance measures.

Parallel processing applications: Massive parallelism for grand challenges, application models for parallel computing, scalability of parallel algorithms. Speedup performance laws: Amdahl's law for fixed workload, Gustafson's Law for scaled problems and memory bounded speedup model. Scalability analysis and approaches: Scalability metrics and goals, evaluation of scalable computers.

Unit-III

Pipelining and Superscalar Techniques: Linear pipeline processors, nonlinear pipeline processors, arithmetic pipeline design, and superscalar pipeline design. Parallel programming models: Shared-variable model, message-passing model, data-parallel model, object-oriented model and functional and logic models.

Case studies of parallel processors: ICL distributed array processor (DAP), ILLIAC IV Computer, Tiler's TILE64 system, Sun UltraSparc T2 processor, Intel Pentium Processors.

Unit-IV

Scheduling and parallelization: Loop parallelization and pipelining-Loop transformation theory, parallelization and wave fronting, tiling and localization, software pipelining, program partitioning and scheduling: Grain size, latency, grain packing and scheduling. Parallel Architecture for cognitive functions: Artificial neuron model (perceptron), neural network as classifiers, learning by perceptrons, supervised training of perceptron networks, SLT model and Hopfield network.

Suggested Books

1. A.Grama, A. Gupta, G.Karypis, V.Kumar, Introduction to Parallel Computing, Pearson.
2. M.R. Bhujade, Parallel Computing, New Age International Publishers.
3. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture-Parallelism, Scalability, Programmability, McGraw Hill.
4. D.Sima, T.Fountain, P.Kasuk, Advanced Computer Architecture-A Design space Approach, Pearson Education, India, 2009.
5. C Lin, L Snyder, Principles of Parallel Programming, Addison-Wesley Publishing Company.
6. M.J. Quinn, Parallel Computing: Theory and Practice, Second Edition, McGraw Hill.
7. T.G.Lewis and H. El-Rewini, Introduction to parallel computing, Prentice Hall.

PE-CS-T305A	Information Theory and Coding						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To introduce information theory, the fundamentals of error control coding techniques and their applications, and basic cryptography.						
Course Outcomes (CO)							
CO1	Students will be introduced to the basic notions of information and channel capacity.						
CO2	Students will be introduced to convolutional and block codes, decoding techniques.						
CO3	Students will understand how error control coding techniques are applied in communication systems.						
CO4	Students will understand the basic concepts of cryptography and able to implement cryptography to real life applications.						

Unit I : Information Theory & Source Coding

Introduction to information theory, Entropy and its properties, Source coding theorem, Huffman coding, Shannon-Fano coding, The Lempel Ziv algorithm, Run Length Encoding, Discrete memory less channel, Mutual information, Examples of Source coding-Audio and Video Compression.

Unit II : Information Capacity & Channel Coding

Channel capacity, Channel coding theorem, Differential entropy and mutual Information for continuous ensembles, Information Capacity theorem, Linear Block Codes: Syndrome and error detection, Error detection and correction capability, Standard array and syndrome decoding, Encoding and decoding circuit, Single parity check codes, Repetition codes and dual codes, Hamming code, Golay Code, Interleaved code.

Unit III : Cyclic Codes, BCH and Convolutional Codes

Galois field, Primitive element & Primitive polynomial, Minimal polynomial and generator polynomial, Description of Cyclic Codes, Generator matrix for systematic cyclic code, Encoding for cyclic code, Syndrome decoding of cyclic codes, Binary BCH code, Generator polynomial for BCH code, Decoding of BCH code, RS codes, generator polynomial for RS code, Decoding of RS codes, Cyclic Hamming code and Golay code. Introduction of convolution code, State diagram, Tree diagram, Trellis diagram, Sequential decoding and Viterbi decoding

UNIT-V: Cryptography

Encryption, Decryption, Cryptogram (cipher text), Concept of cipher, Cryptanalysis, Keys: Single key (Secret key), Cryptography, two-key (Public key) cryptography, Single key cryptography, Ciphers, Block Cipher code, Stream ciphers, Requirements for secrecy, The data Encryption Standard, Public Key Cryptography, Diffie-Hellmann public key distribution, The Rivest- Shamir Adelman(R-S-A) system for public key cryptography, Digital Signature.

Suggested Books:

- Jorge Castiñeira Moreira, Patrick Guy Farrell , Essentials of Error-Control Coding John Wiley, 2006. ISBN: 978-0-470-02920-6
- G. A. Jones and J. M. Jones, "Information and Coding Theory," Springer ISBN 1-85233-622-6, 3rd Edition.
- Dominic Welsh, Codes and Cryptography, Oxford Science Publications, 1988
- T. M. Cover, J. A. Thomas, "Elements of information theory," Wiley-Interscience, 2nd Edition, 2006/ •
- R. W. Hamming, "Coding and information theory," Prentice Hall Inc., 1980

PE-CS-T307A	Advanced Algorithms						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	0	0	3	75	25	100	3 Hrs.
Purpose	To introduce advanced algorithm concepts and their implementation for solving complex applications.						
Course Outcomes(CO)							
CO1	Learn the basic concepts of Algorithms and their analysis.						
CO2	Study the concept of dynamic programming and various advanced data structures.						
CO3	Learn various graph algorithms.						
CO4	Study various Flow and Sorting Networks.						

UNIT – I: Introduction

Algorithms and its complexity (Time and Space), Algorithm Analysis (Worst, Best & Average case), Pseudocode Conventions, Asymptotic Notations, Binary Search Trees.

Recurrence Relation:- Methods for solving Recurrence(Substitution, Recursion Tree , Master Theorem).

UNIT – II: Advanced Design Techniques

Dynamic Programming:- Elements, Matrix-chain multiplication, longest common subsequence.

Greedy Algorithms:- Elements, Activity Selection problem, Huffman codes, Task scheduling problem, Knapsack Problem, .

Probabilistic analysis concepts, Hiring Problem and its probabilistic analysis.

UNIT – III: Graph Algorithms

Review of Graph Algorithms:- Traversal methods(Depth first and Breadth first search), Topological sort, Strongly connected components, Minimum Spanning Trees- Kruskal and Prims, Single Source shortest path, Relaxation, Dijkstra's Algorithm, Bellman-Ford Algorithm, Single source shortest path for directed acyclic graphs, All pair shortest path- Floyd Warshall Algorithm.

UNIT – IV: String Matching Algorithms

The Naïve string-matching algorithm, Rabin-Karp Algorithm, String matching with finite automata, Knuth-Morris-Pratt Algorithm.

Suggested Books:

1. L.K. Vermani, S. Vermani, An Elementary Approach to Design and Analysis of Algorithms, World Scientific, 2019
2. Cormen, Leiserson and Rivest : Introduction to Algorithms, 3/e, PHI
3. Harsh Bhaisn, Algorithms: Design And Analysis Oxford University Press,2015.
4. Aho, Hopcroft and Ullman : The Design and Analyses of Computer Algorithms. Addison Wesley.
5. R.B.Patel& M.M.S Rauthan, Expert Data Structures with C++, Khana Publications, Delhi , India, 2ndEdition 2004,ISBN : 87522-03-8.
6. Horowitz, Ellis and Sahni, Sartaj : Fundamentals of Computer Algorithms, Galgotia Publications

MC-904A	Energy Resources & Management						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	0	100	-	100	3
Purpose	To make the students conversant with the basics concepts and conversion of various form of Energy						
COURSE OUTCOMES							
CO1	An overview about Energy Resources, Conventional and Non-conventional sources						
CO2	Understand the Layout and working of Conventional Power Plants						
CO3	Understand the Layout and working of Non-Conventional Power Plants						
CO4	To understand the Energy Management, Audit and tariffs, Role of Energy in Economic development and Energy Scenario in India						

UNIT-I

Introduction: Types of energy, Conversion of various forms of energy, Conventional and Non-conventional sources, Need for Non-Conventional Energy based power generation.

UNIT-II

Conventional Energy sources: Types of Conventional Energy sources, Selection of site, working of Thermal, Hydro, Nuclear and Diesel power plants and their schematic diagrams & their comparative advantages/ disadvantages.

UNIT-III

Non-Conventional Energy sources: Types of Non-Conventional Energy sources , Basic principle, site selection of Solar energy power plant, photovoltaic technologies, PV Systems and their components, Wind energy power plant , Bio energy plants ,Geothermal energy plants and Tidal energy plants.

UNIT-IV

Energy Management: General Principles of Energy Management, Energy Management Strategy, Modern trends and developments towards Computerizations of Power System.

Energy Audit: Need, Types, Methodology and Approach.

Energy Scenario: Lay out of power system, Role of Energy in Economic development, energy demand, availability and consumption, Indian energy scenario, long term energy scenario, energy sector reforms in India, energy strategy for the future.

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4. NEDCAP: Non Conventional Energy Guide Lines
5. Non conventional energy sources : G.D. Roy
6. Non Conventional energy resources :B H Khan - McGraw Hill
7. Applied Solar Energy : Meinel A B - Addison Wesley Publications
8. Direct Energy ConversionGeorge: Sutton -McGraw