BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE
(UGC-AUTONOMOUS)
M. Tech. in COMPUTER SCIENCE AND ENGINEERING
Course Structure & Syllabus (R25Regulations)
Applicable from AY 2025-2026 Batch

I YEAR I –SEMESTER

S.No	Course Code	Course Title	L	T	P	Credits
1	25DCS101PC	Mathematical Foundations of Computer Science	3	0	0	3
2	25DCS102PC	Advanced Data Structures	3	0	0	3
3	**Professional Elective-I**					
	25DCS104PE	Database Programming with PL/SQL	3	0	0	3
	25DCS106PE	Deep Learning				
	25DCS108PE	Natural Language Processing				
	25DCS110PE	Advanced UNIX Programming				
4	**Professional Elective-II**					
	25DCS112PE	Applied Cryptography	3	0	0	3
	25DCS113PE	Software Quality Engineering				
	25DCS114PE	Mining Massive Datasets				
	25DCS115PE	Agile Methodologies				
5	25DCS103PC	Advanced Data Structures Lab	0	0	4	2
6	25DCS105PE	Database Programming with PL/SQL Lab	0	0	4	2
	25DCS107PE	Deep Learning Lab				
	25DCS109PE	Natural Language Processing Lab				
	25DCS111PE	Advanced UNIX Programming Lab				
7	25DVA101HS	Research Methodology &IPR	2	0	0	2
8	**Audit Course-I**		2	0	0	0
	25DAC101HS	English for Research Paper Writing				
	25DAC102HS	Disaster Management				
	25DAC103HS	Sanskrit for Technical Knowledge				
	25DAC104HS	Value Education				
		Total	**16**	**0**	**8**	**18**

I YEAR II –SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	25DCS216PC	Advanced Algorithms	3	0	0	3
2	25DCS218PC	Advanced Computer Architecture	3	0	0	3
3	**Professional Elective-III**		3	0	0	3
	25DCS219PE	Enterprise Cloud Concepts				
	25DCS221PE	Cyber Security				
	25DCS223PE	Parallel computing				
	25DCS225PE	Large Language Models				
4	**Professional Elective-IV**		3	0	0	3
	25DCS227PE	Bioinformatics				
	25DCS228PE	AdhocSensor Networks				
	25DCS229PE	Robotic Process Automation				
	25DCS230PE	Generative AI				
5	25DCS217PC	Advanced Algorithms Lab	0	0	4	2
6	25DCS220PE	Enterprise Cloud Concepts Lab	0	0	4	2
	25DCS222PE	Cyber Security Lab				
	25DCS224PE	Parallel computing Lab				
	25DCS226PE	Large Language Models Lab				
	25DCS235PR	Mini Project with Seminar	0	0	4	2
7	**Audit Course- II**		2	0	0	0
	25DAC205HS	Constitution of India				
	25DAC206HS	Pedagogy Studies				
	25DAC207HS	Stress Management by yoga				
	25DAC208HS	Personality Development Through Life Enlightenment Skills				
		Total	**14**	**0**	**12**	**18**

II YEAR I– SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	**Professional Elective-V**		3	0	0	3
	25DCS331PE	Digital Forensics				
	25DCS332PE	Advanced Operating Systems				
	25DCS333PE	Quantum Computing				
	25DCS334PE	Prompt Engineering				
2	Open Elective		3	0	0	3
	25DMS301OE	Entrepreneurship				
	25DEE301OE	Introduction to Fuzzy logic and Neural networks				
	25DEC301OE	VLSI Design				
3	25DCS336PR	Dissertation Work Review–II	0	0	18	6
		Total	**6**	**0**	**18**	**12**

II YEAR II-SEMESTER

S.No.	Course Code	Course Title	L	T	P	Credits
1	25DCS437PR	Dissertation Work Review–III	0	0	18	6
2	25DCS438PR	Dissertation Viva-Voce	0	0	42	14
		Total	**0**	**0**	**60**	**20**

***ForDissertationWorkReview-I,PleasereferR25AcademicRegulations.**

Audit Course I&II:

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by yoga
8. Personality Development Through Life Enlightenment Skills

Open Electives for other Departments:

1. Advanced Operating Systems
2. Generative AI
3. Prompt Engineering
4. Digital Forensic.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS101PC: MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE (PC-I)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Pre-requisites: An understanding of Math in general is sufficient.

Course Objectives:

1. Introduce the elementary discrete mathematics concepts relevant to computer science and engineering.
2. Cover formal logic notation, methods of proof including induction, sets, relations, and graph theory.
3. Explore permutations, combinations, counting principles, recurrence relations, and generating functions.

Course Outcomes: After learning the contents of this subject, the student must be

1. Ability to understand and construct precise mathematical proofs using logic and various proof techniques.
2. Ability to use logic and set theory to formulate precise mathematical and computational statements.
3. Ability to analyze and solve counting problems on finite and discrete structures using combinatorial techniques.
4. Ability to describe, manipulate, and apply sequences, recurrence relations, and generating functions.
5. Ability to apply graph theory and tree algorithms to solve computing problems involving connectivity, shortest paths, and spanning trees.

UNIT-I

The Foundations Logic and Proofs: Propositional Logic, Applications of Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs, Proof Methods and Strategy.

UNIT-II

Basic Structures, Sets, Functions, Sequences, Sums, Matrices and Relations: Sets, Functions, Sequences & Summations, Cardinality of Sets and Matrices Relations, Relations and Their Properties, n-ary Relations and Their Applications, Representing Relations, Closures of Relations, Equivalence Relations, Partial Orderings.

UNIT-III

Algorithms, Induction and Recursion: Algorithms, The Growth of Functions, Complexity of Algorithms.
Induction and Recursion: Mathematical Induction, Strong Induction and Well-Ordering, Recursive Definitions and Structural Induction, Recursive Algorithms, Program Correctness.

UNIT-IV

Discrete Probability and Advanced Counting Techniques:
An Introduction to Discrete Probability. Probability Theory, Bayes' Theorem, Expected Value and Variance.
Advanced Counting Techniques:
Recurrence Relations, Solving Linear Recurrence Relations, Divide-and-Conquer Algorithms and Recurrence Relations, Generating Functions, Inclusion-Exclusion, Applications of Inclusion-Exclusion.

UNIT-V

Graphs: Graphs and Graph Models, Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, Shortest-Path Problems, Planar Graphs, Graph Coloring.
Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees, Minimum Spanning Trees.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph.P. Grimald, Pearson education, 5th edition.
2. Discrete Mathematical Structures: Thomas Kosy, Tata McGraw Hill publishing co.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS102PC: ADVANCED DATA STRUCTURES (PC-II)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites

1. A course on "Data Structures".

Course Objectives

1. Introduce advanced heap structures including Min-Max Heaps, Leftist Trees, Binomial and Fibonacci Heaps.
2. Understand hashing techniques, hash tables, various hash functions, and collision resolution methods.
3. Explore search tree structures such as OBST, AVL trees, Red-Black trees, Splay trees, and multiway search trees including B-trees and 2-3 trees.

Course Outcomes

1. Ability to understand and implement advanced heap data structures and analyze their applications.
2. Ability to design and apply efficient hashing techniques and resolve collisions effectively.
3. Ability to analyze, implement, and use various balanced and multiway search trees for efficient data storage and retrieval.
4. Ability to describe and implement digital search structures for optimized string and data retrieval operations.
5. Ability to understand and apply various pattern matching algorithms in text processing and searching problems.

UNIT - I

Heap Structures

Introduction, Min-Max Heaps, Leftist trees, Binomial Heaps, Fibonacci heaps.

UNIT - II

Hashing and Collisions

Introduction, Hash Tables, Hash Functions, different Hash Functions:- Division Method, Multiplication Method, Mid-Square Method, Folding Method, Collisions

UNIT - III

Search Structures

OBST, AVL trees, Red-Black trees, Splay trees,

Multiway Search Trees

B-trees, 2-3 trees

UNIT - IV

Digital Search Structures

Digital Search trees, Binary tries and Patricia, Multiway Tries, Suffix trees, Standard Tries, Compressed Tries

UNIT - V

Pattern matching

Introduction, Brute force, the Boyer –Moore algorithm, Knuth-Morris-Pratt algorithm, Naïve String, Harspool, Rabin Karp

TEXT BOOKS:

1. Fundamentals of data structures in C++ Sahni, Horowitz, Mehatha, Universities Press.
2. Introduction to Algorithms, TH Cormen, PHI

REFERENCES:

1. Design methods and analysis of Algorithms, SK Basu, PHI.
2. Data Structures & Algorithm Analysis in C++, Mark Allen Weiss, Pearson Education.
3. Fundamentals of Computer Algorithms, 2nd Edition, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Universities Press.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS104PE: DATABASE PROGRAMMING WITH PL/SQL (PROFESSIONAL ELECTIVE - I)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the fundamentals of PL/SQL programming including block structure, data types, control structures, exceptions, and transaction scope.
2. Explore PL/SQL language elements such as lexical units, variables, conditional and iterative statements, cursors, and collections like Varray, Tables, and Associative Arrays.
3. Learn to design and implement functions and procedures, understand their architecture, transaction scope, and parameter passing methods.

Course Outcomes:

1. Ability to write efficient PL/SQL programs using blocks, control structures, exception handling, and transaction management.
2. Ability to utilize PL/SQL language fundamentals such as cursors, collections, and control statements to manipulate data effectively.
3. Ability to create and use PL/SQL functions and procedures with various parameter passing techniques to modularize code.
4. Ability to design, implement, and manage PL/SQL packages for reusable and organized code development.
5. Ability to develop and deploy triggers to automate and enforce business rules and database integrity.

Unit I

PL/SQL Basics

Block Structure, Behavior of Variables in Blocks, Basic Scalar and Composite Data Types, Control Structures, Exceptions, Bulk Operations, Functions, Procedures, and Packages, Transaction Scope

Unit II

Language Fundamentals & Control Structures

Lexical Units, Variables and Data Types, Conditional Statements, Iterative Statements, Cursor Structures, Bulk Statements, Introduction to Collections, Object Types: Varray and Table Collections, Associative Arrays, Oracle Collection API

Unit III

Functions and Procedures

Function and Procedure Architecture, Transaction Scope, Calling Subroutines, Positional Notation, Named Notation, Mixed Notation, Exclusionary Notation, SQL Call Notation, Functions, Function Model Choices, Creation Options, Pass-by-Value Functions, Pass-by-Reference Functions, Procedures, Pass-by-Value Procedures, Pass-by-Reference Procedures, Supporting Scripts.

Unit IV

Packages

Package Architecture, Package Specification, Prototype Features, Serially Reusable Precompiler Directive, Variables, Types, Components: Functions and Procedures, Package Body, Prototype Features, Variables, Types, Components: Functions and Procedures, Definer vs. Invoker Rights Mechanics, Managing Packages in the Database Catalog, Finding, Validating, and Describing Packages, Checking Dependencies, Comparing Validation Methods: Timestamp vs. Signature.

Unit V

Triggers

Introduction to Triggers, Database Trigger Architecture, Data Definition Language Triggers, Event Attribute Functions, Building DDL Triggers, Data Manipulation Language Triggers, Statement-Level Triggers, Row-Level Triggers, Compound Triggers, INSTEAD OF Triggers, System and Database Event Triggers, Trigger Restrictions, Maximum Trigger Size, SQL Statements, LONG and LONG RAW Data Types.

TEXT BOOKS:

1. Oracle Database 12c PL/SQL Programming Michael McLaughlin, McGraw Hill Education.

REFERENCES:

1. Benjamin Rosenzweig, Elena Silvestrova Rakhimov, Oracle PL/SQL by example Fifth Edition.
2. Dr. P. S. Deshpande, SQL & PL / SQL for Oracle 11g Black Book.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS106PE: DEEP LEARNING (PROFESSIONAL ELECTIVE - I)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the fundamentals of feedforward neural networks, backpropagation, and optimization techniques including gradient descent and its variants.
2. Explore advanced neural network architectures such as Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs), LSTM, GRU, and deep unsupervised learning models like autoencoders and GANs.
3. Study applications of deep learning in computer vision including image segmentation, object detection, image captioning, and video-to-text generation.

Course Outcomes:

1. Ability to understand and implement feedforward neural networks and optimization algorithms like gradient descent and its heuristics.
2. Ability to design and apply convolutional and recurrent neural network architectures for various deep learning tasks.
3. Ability to develop deep learning solutions for computer vision problems including image segmentation, object detection, and image generation.
4. Ability to apply deep learning models to NLP tasks, leveraging word embeddings and vector space representations for semantic understanding.
5. Ability to implement advanced NLP applications such as sentiment analysis, named entity recognition, and dialogue generation using RNNs, CNNs, and recursive networks.

UNIT - I

Introduction: Feed forward Neural networks, Gradient descent and the back propagation algorithm, Unit saturation, the vanishing gradient problem, and ways to mitigate it. RelU Heuristics for avoiding bad local minima, Heuristics for faster training, Nestors accelerated gradient descent, Regularization, Dropout

UNIT - II

Convolutional Neural Networks: Architectures, convolution/pooling layers, Recurrent Neural Networks: LSTM, GRU, Encoder Decoder architectures. Deep Unsupervised Learning: Auto encoders, Variational Auto-encoders, Adversarial Generative Networks, Auto-encoder and DBM Attention and memory models, Dynamic Memory Models

UNIT - III

Applications of Deep Learning to Computer Vision: Image segmentation, object detection, automatic image captioning, Image generation with Generative adversarial networks, video to text with LSTM models, Attention Models for computer vision tasks

UNIT -IV

Applications of Deep Learning to NLP: Introduction to NLP and Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity

UNIT -V

Analogy reasoning: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks: Parsing and Sentiment Analysis using Recursive Neural Networks: Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCES:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Extensive Reading:

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS108PE: NATURAL LANGUAGE PROCESSING (PROFESSIONAL ELECTIVE - I)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

1. Data structures, finite automata and probability theory.

Course Objectives:

1. Understand the morphological structure of words and documents, including models and challenges in finding word and document structure.
2. Explore syntax analysis techniques, including parsing natural language, treebanks, syntactic representations, and ambiguity resolution.
3. Study semantic parsing, semantic interpretation, and systems for word sense disambiguation.
4. Gain knowledge of discourse processing, cohesion, reference resolution, and language modeling techniques including n-gram models and multilingual language modeling.

Course Outcomes:

1. Ability to analyze the morphological components of words and documents using appropriate models and techniques.
2. Ability to apply syntax analysis and parsing algorithms for natural language understanding and ambiguity resolution.
3. Ability to implement semantic parsing and word sense disambiguation using relevant tools and systems.
4. Ability to describe and utilize predicate-argument structures and meaning representation frameworks in NLP applications.
5. Ability to apply discourse processing techniques and build effective language models for monolingual and multilingual contexts.

UNIT - I

Finding the Structure of Words: Words and Their Components, Issues and Challenges, Morphological Models

Finding the Structure of Documents: Introduction, Methods, Complexity of the Approaches, Performances of the Approaches

UNIT - II

Syntax Analysis: Parsing Natural Language, Treebanks: A Data-Driven Approach to Syntax, Representation of Syntactic Structure, Parsing Algorithms, Models for Ambiguity Resolution in Parsing, Multilingual Issues

UNIT - III

Semantic Parsing: Introduction, Semantic Interpretation, System Paradigms, Word Sense Systems, Software.

UNIT - IV

Predicate-Argument Structure, Meaning Representation Systems, Software.

UNIT - V

Discourse Processing: Cohesion, Reference Resolution, Discourse Cohesion and Structure Language Modeling: Introduction, N-Gram Models, Language Model Evaluation, Parameter Estimation, Language Model Adaptation, Types of Language Models, Language-Specific Modeling Problems, Multilingual and Cross Lingual Language Modeling

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication.
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary.

REFERENCES:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS110PE: ADVANCED UNIX PROGRAMMING (PROFESSIONAL ELECTIVE - I)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand Linux utilities including file handling, process management, disk, networking, text processing, and backup commands.
2. Learn shell programming with bash, covering scripting basics, control structures, functions, and debugging.
3. Explore file and directory management, system calls for file I/O, file permissions, ownership, and directory operations.
4. Understand process management concepts including process creation, termination, signals, and kernel support for processes and signals.
5. Study Interprocess Communication (IPC) mechanisms such as pipes, message queues, semaphores, shared memory, and sockets for local and networked environments.

Course Outcomes:

1. Ability to efficiently use Linux utilities for file handling, process control, text processing, and system management.
2. Ability to write and debug shell scripts using bash to automate system tasks and manage processes.
3. Ability to manage files and directories programmatically using Linux system calls and understand file metadata and permissions.
4. Ability to create and manage processes, handle signals, and understand process lifecycle in a Linux environment.
5. Ability to implement Interprocess Communication using pipes, message queues, semaphores, shared memory, and sockets in both local and networked systems.

UNIT- I

Linux Utilities - File handling utilities, Security by file permissions, Process utilities, Disk utilities, Networking commands, Filters, Text processing utilities and Backup utilities.

Shell programming with Bourne again shell (bash) - Introduction, shell responsibilities, pipes and Redirection, here documents, running a shell script, the shell as a programming language, shell meta characters, file name substitution, shell variables, command substitution, shell commands, the environment, quoting, test command, control structures, arithmetic in shell, shell script examples, interrupt processing, functions, debugging shell scripts.

UNIT- II

Files and Directories - File Concept, File types, File System Structure, file metadata-Inodes, kernel support for files, system calls for file I/O operations- open, creat, read, write, close, lseek, dup2, file status information-stat family, file and record locking- fcntl function, file permissions - chmod, fchmod, file ownership-chown, lchown, fchown, links-soft links and hard links – symlink, link, unlink.

Directories- Creating, removing and changing Directories- mkdir, rmdir, chdir, obtaining current working directory- getcwd, Directory contents, Scanning Directories-opendir, readdir, closedir, rewinddir functions.

UNIT- III

Process – Process concept, Layout of a C program image in main memory, Process environment- environment list, environment variables, getenv, setenv, Kernel support for process, process identification, process control - process creation, replacing a process image, waiting for a process, process termination, zombie process, orphan process, system call interface for process management- fork, vfork, exit, wait, waitpid, exec family, Process Groups, Sessions and Controlling Terminal, Differences between threads and processes.

Signals – Introduction to signals, Signal generation and handling, Kernel support for signals, Signal function, unreliable signals, reliable signals, kill, raise, alarm, pause, abort, sleep functions.

UNIT- IV

Interprocess Communication - Introduction to IPC, IPC between processes on a single computer system, IPC between processes on different systems, pipes-creation, IPC between related processes using unnamed pipes, FIFOs-creation, IPC between unrelated processes using FIFOs (Named pipes), differences between unnamed and named pipes, popen and pclose library functions. **Message Queues** - Kernel support for messages, APIs for message queues, client/server example. **Semaphores** - Kernel support for semaphores, APIs for semaphores, file locking with semaphores.

UNIT- V

Shared Memory - Kernel support for shared memory, APIs for shared memory, shared memory example. **Sockets** - Introduction to Berkeley Sockets, IPC over a network, Client- Server model, Socket address structures (Unix domain and Internet domain),Socket system calls for connection oriented protocol and connectionless protocol, example-client/server programs-Single Server-Client connection, Multiple simultaneous clients, Socket options- setsockopt and fcntl system calls, Comparison of IPC mechanisms.

TEXT BOOKS:

1. Unix System Programming using C++, T. Chan, PHI.
2. Advanced Programming in the Unix Environment, 2nd edition, W. R. Stevens and S. A. Rago, Pearson Education.
3. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
4. Unix Network Programming, W. R. Stevens, PHI.

REFERENCE BOOKS:

1. C Programming Language, Kernighan and Ritchie, PHI.
2. Beginning Linux Programming, 4th Edition, N. Matthew, R. Stones, Wrox, Wiley India Edition.
3. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson.
4. System Programming with C and Unix, A. Hoover, Pearson.
5. Unix System Programming, Communication, Concurrency and Threads, K. A. Robbins and S. Robbins, Pearson Education.
6. Unix shell Programming, S. G. Kochan and P. Wood, 3rd edition, Pearson Education.
7. Shell Scripting, S. Parker, Wiley India Pvt. Ltd.
8. Unix and Shell programming, B. A. Forouzan and R. F. Gilberg, Cengage Learning.
9. Linux System Programming, Robert Love, O'Reilly, SPD.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS112PE: APPLIED CRYPTOGRAPHY (PROFESSIONAL ELECTIVE - II)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. Understand foundational concepts of cryptography including steganography, substitution and transposition ciphers, and cryptographic protocols.
2. Explore symmetric and public-key cryptographic techniques, key lengths, and various cipher modes of operation.
3. Study public-key algorithms such as RSA, ElGamal, Elliptic Curve Cryptosystems, and digital signature algorithms.

Course Outcomes:

1. Ability to explain and apply basic cryptographic concepts and protocols including symmetric and asymmetric cryptography.
2. Ability to analyze and implement various cryptographic techniques and cipher modes for secure communication.
3. Ability to understand and use public-key algorithms and digital signature schemes for authentication and data integrity.
4. Ability to apply advanced cryptographic protocols for secure multiparty computation, zero-knowledge proofs, and privacy-preserving applications.
5. Ability to describe and utilize real-world cryptographic protocols and standards in practical security systems.

Unit I

Foundations:

Terminology, Steganography, Substitution Ciphers and Transposition Ciphers, Simple XOR, One- Time Pads, Computer Algorithms, Large Numbers,

Cryptographic Protocols: Protocol Building Blocks

Introduction to Protocols, Communications Using Symmetric Cryptography, One-Way Functions, One- Way Hash Functions, Communications Using Public-Key Cryptography, Digital Signatures, Digital Signatures with Encryption, Random and Pseudo-Random-Sequence Generation

Unit II Cryptographic Techniques

Key length: Symmetric Key length, Public key length, comparing symmetric and public key length. **Algorithm types and modes:** Electronic Codebook Mode, Block Replay, Cipher Block Chaining Mode, Stream Cipher, Self-Synchronizing Stream Ciphers, Cipher-Feedback Mode, Synchronous Stream Ciphers, Output-Feedback Mod, Counter Mode, Other Block-Cipher Modes.

Unit III Public-Key Algorithms

Background, Knapsack Algorithms, RSA, Pohlig-Hellman, Rabin, ElGamal, McEliece, Elliptic Curve Cryptosystems, LUC, Finite Automaton Public-Key Cryptosystems

Public-Key Digital Signature Algorithms: Digital Signature Algorithm (DSA), DSA Variants, Gost Digital Signature Algorithm, Discrete Logarithm Signature Schemes, Ong-Schnorr-Shamir, ESIGN

Unit IV Special Algorithms for Protocols

Multiple-Key Public-Key Cryptography, Secret-Sharing Algorithms, Subliminal Channel, Undeniable Digital Signatures, Designated Confirmer Signatures, Computing with Encrypted Data, Fair Coin Flips, One-Way Accumulators, All-or-Nothing Disclosure of Secrets, Fair and Failsafe Cryptosystems, Zero- Knowledge Proofs of Knowledge, Blind Signatures, Oblivious Transfer, Secure Multiparty Computation, Probabilistic Encryption, Quantum Cryptography

Unit V Real World Approaches

IBM Secret key management protocol, ISDN, Kerberos, KryptoKnight, Privacy enhanced mail (PEM), Message security protocol (MSP), PGP, Public-Key Cryptography Standards (PKCS), Universal Electronic Payment System (UEPS).

TEXT BOOKS:

1. Bruce Schneier, Applied Cryptography, Second Edition: Protocols, Algorithms, and Source Code in C (cloth).

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS113PE: SOFTWARE QUALITY ENGINEERING (PROFESSIONAL ELECTIVE - II)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand software quality concepts, quality frameworks like ISO-9126, and the measurement of correctness and defects.
2. Explore quality assurance techniques including defect prevention, defect reduction through inspection and testing, and defect containment strategies.
3. Study quality engineering processes, quality planning, assessment, and continuous improvement in software development.

Course Outcomes:

1. Ability to explain software quality concepts, frameworks, and measure software defects and correctness.
2. Ability to apply quality assurance techniques for defect prevention, detection, and containment in software projects.
3. Ability to implement quality engineering practices for planning, assessment, and improvement of software processes.
4. Ability to design and manage software testing activities including automation and effective test result analysis.
5. Ability to apply checklist-based testing, partition coverage, and usage-based statistical testing using operational profiles in real-world scenarios.

Unit I Software Quality

Quality: perspectives and expectations, Quality frameworks and ISO-9126, correctness and defects: Definitions, properties and Measurements, A historical perspective of quality, software quality.

Unit II Quality Assurance

Classification: QA as dealing with defects, Defect prevention- Education and training, Formal method, Other defect prevention techniques, Defect Reduction - Inspection: Direct fault detection and removal, Testing: Failure observation and fault removal, other techniques and risk identification, Defect Containment- software fault tolerance, safety assurance and failure containment

Unit III Quality Engineering

Quality Engineering: Activities and process, Quality planning: Goal setting and Strategy formation, Quality assessment and Improvement, Quality engineering in software process.

Unit IV Test Activities, Management and Automation

Test planning and preparation, Test execution, Result checking and measurement, Analysis and follow- up, Activities People and Management, Test Automation.

Unit V Coverage and usage testing based on checklist and partitions

Checklist based testing and its limitations, Testing for partition Coverage, Usage based Statistical testing with Musa's operational profiles, Constructing operational profiles

Case Study: OP for the cartridge Support Software

TEXT BOOKS:

1. Jeff Tian, Software Quality Engineering, Testing, Quality Assurance, and Quantifiable improvement
2. Richard N. Taylor, Software Architecture: Foundations, Theory, and Practice

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS114PE: MINING MASSIVE DATASETS (PROFESSIONAL ELECTIVE - II)

M.Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Prerequisites:

1. Students should be familiar with Data mining, algorithms, basic probability theory and Discrete math.

Course Objectives:

1. Understand the fundamentals of data mining, MapReduce framework, and distributed file systems for processing large datasets.
2. Explore similarity search techniques, near-neighbor search applications, and methods for mining streaming data.
3. Study link analysis algorithms like PageRank, frequent itemset mining, and clustering techniques for large-scale data.

Course Outcomes:

1. Ability to understand and implement MapReduce algorithms and distributed data mining techniques for massive datasets.
2. Ability to apply similarity search and streaming data mining methods to handle large-scale, real-time data.
3. Ability to design and analyze link analysis, frequent itemset mining, and clustering algorithms for big data.
4. Ability to develop and evaluate online advertising algorithms and build recommendation systems using collaborative filtering and dimensionality reduction.
5. Ability to apply graph mining techniques to social network data for clustering, partitioning, and similarity measurement.

UNIT I

Data Mining-Introduction-Definition of Data Mining-Statistical Limits on Data Mining,
MapReduce and the New Software Stack-Distributed File Systems, MapReduce, Algorithms Using MapReduce.

UNIT II

Similarity Search: Finding Similar Items-Applications of Near-Neighbor Search, Shingling of Documents, Similarity-Preserving Summaries of Sets, Distance Measures.
Streaming Data: Mining Data Streams-The Stream Data Model , Sampling Data in a Stream, Filtering Streams

UNIT III

Link Analysis-PageRank, Efficient Computation of PageRank, Link Spam
Frequent Itemsets-Handling Larger Datasets in Main Memory, Limited-Pass Algorithms, Counting Frequent Items in a Stream.
Clustering-The CURE Algorithm, Clustering in Non-Euclidean Spaces, Clustering for Streams and Parallelism

UNIT IV

Advertising on the Web-Issues in On-Line Advertising, On-Line Algorithms, The Matching Problem, The Adwords Problem, Adwords Implementation.
Recommendation Systems-A Model for Recommendation Systems, Content-Based Recommendations, Collaborative Filtering, Dimensionality Reduction, The NetFlix Challenge.

UNIT V

Mining Social-Network Graphs-Social Networks as Graphs, Clustering of Social-Network Graphs, Partitioning of Graphs, Simrank, Counting Triangles

TEXT BOOKS:

1. Jure Leskovec, Anand Rajaraman, Jeff Ullman, Mining of Massive Datasets, 3rd Edition.

REFERENCE BOOKS:

1. Jiawei Han & Micheline Kamber , Data Mining – Concepts and Techniques 3rd Edition Elsevier.
2. Margaret H Dunham, Data Mining Introductory and Advanced topics, PEA.
3. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS115PE: AGILE METHODOLOGIES (PROFESSIONAL ELECTIVE - II)

M. Tech CSE I Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. Understand the principles and practices of Agile development and Extreme Programming (XP), including the Agile mindset and XP lifecycle.
2. Explore collaboration techniques in Agile teams focusing on trust, customer involvement, communication, and coding standards.
3. Learn best practices for releasing software including version control, continuous integration, collective ownership, and documentation.

Course Outcomes

1. Ability to apply Agile principles and Extreme Programming concepts effectively in software development projects.
2. Ability to foster collaboration and communication within Agile teams, ensuring real customer involvement and shared understanding.
3. Ability to implement effective software release processes including version control and continuous integration.
4. Ability to plan and manage Agile projects through release planning, risk assessment, and iteration management.
5. Ability to develop high-quality software using Agile development practices like test-driven development, refactoring, and exploratory testing.

UNIT - I

Introduction Extreme Programming (XP) - Agile Development

Why Agile - Understanding Success, Beyond Deadlines, Importance of Organizational Success, Introduction to Agility How to Be Agile - Agile methods, Don't make your own method, Road to mastery Understanding XP (Extreme Programming) - XP life cycle, XP team, XP Concepts Adopting XP - Knowing whether XP is suitable, Implementing XP, assessing Agility Practicing XP - Thinking - Pair Programming, Energized work, Informative Workspace, Root cause Analysis, Retrospectives

UNIT - II

Collaborating

Trust, Sit together, Real customer involvement, Ubiquitous language, meetings, coding standards, Iteration demo, Reporting

UNIT - III

Releasing

Bug free Release, Version Control, fast build, continuous integration, Collective ownership, Documentation

UNIT – IV

Planning

Version, Release Plan, Risk Management, Iteration Planning, Slack, Stories, Estimating

UNIT - V

Developing:

Incremental requirements, Customer tests, Test driven development, Refactoring,
Incremental design and architecture, spike solutions, Performance optimization, Exploratory testing

TEXT BOOK:

1. The art of Agile Development, James Shore and Shane Warden, 11th Indian Reprint, O'Reilly,2018.

REFERENCES:

1. Learning Agile, Andrew Stellman and Jennifer Greene, O'Reilly, 4th Indian Reprint, 2018.
2. Practices of an Agile Developer, Venkat Subramaniam and Andy Hunt, SPD, 5th Indian Reprint, 2015.
3. Agile Project Management - Jim Highsmith, Pearson Low price Edition 2004.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS103PC: ADVANCED DATA STRUCTURES LAB (LAB - I)

M. Tech CSE I Year I Sem.

L	T	P	C
0	0	4	2

Prerequisites: A course on Computer Programming & Data Structures

Course Objectives:

1. Introduce the basic concepts of Abstract Data Types (ADTs) and their implementations.
2. Review fundamental data structures such as binary search trees, heaps, and B-trees.
3. Introduce advanced tree structures including AVL trees, Red-Black trees, Leftist trees, Binomial heaps, and their operations.
4. Introduce sorting algorithms like Merge Sort, Heap Sort, and Quick Sort along with pattern matching algorithms.

Course Outcomes:

1. Ability to select appropriate data structures to efficiently model and solve computational problems.
2. Ability to assess the efficiency and trade-offs among different data structure implementations and algorithms.
3. Implement and apply sorting and pattern matching algorithms effectively to real-world problems.
4. Design and develop programs using a variety of data structures including hash tables, binary trees, AVL trees, Red-Black trees, heaps, B-trees, and pattern matching techniques.
5. Apply advanced data structures and algorithms to design optimized solutions and analyze their performance in practical scenarios.

List of Programs

1. Write a program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.

2. Write a program for implementing the following sorting methods:
   a) Merge sort b) Heap sort c) Quick sort

3. Write a program to perform the following operations:
   a) Insert an element into a B- tree.
   b) Delete an element from a B- tree.
   c) Search for a key element in a B- tree.

4. Write a program to perform the following operations:
   a) Insert an element into a Min-Max heap
   b) Delete an element from a Min-Max heap
   c) Search for a key element in a Min-Max heap

5. Write a program to perform the following operations:
   a) Insert an element into a Lefiist tree
   b) Delete an element from a Leftist tree
   c) Search for a key element in a Leftist tree

6. Write a program to perform the following operations:
   a) Insert an element into a binomial heap
   b) Delete an element from a binomial heap.
   c) Search for a key element in a binomial heap

7. Write a program to perform the following operations:
   a) Insert an element into a AVL tree.
   b) Delete an element from a AVL search tree.
   c) Search for a key element in a AVL search tree.

8. Write a program to perform the following operations:
   a) Insert an element into a Red-Black tree.
   b) Delete an element from a Red-Black tree.
   c) Search for a key element in a Red-Black tree.

9. Write a program to implement all the functions of a dictionary using hashing.

10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.

11. Write a program for implementing Brute Force pattern matching algorithm.

12. Write a program for implementing Boyer pattern matching algorithm.

TEXT BOOKS:

1. Fundamentals of Data structures in C, E. Horowitz, S. Sahni and Susan Anderson Freed, 2nd Edition, Universities Press
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1st Edition, Pearson.

REFERENCES:

1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data structures: A Pseudocode Approach with C, R.F. Gilberg And B.A. Forouzan, 2nd Edition, Cengage Learning

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS105PE: DATABASE PROGRAMMING WITH PL/SQL LAB (LAB - II)

M. Tech CSE I Year I Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. Introduce the fundamentals of PL/SQL programming including loops, cursors, exceptions, and control structures.
2. Develop skills to manipulate and manage database operations using PL/SQL blocks, procedures, functions, and packages.
3. Understand how to embed PL/SQL within host languages such as C and Java for real-world applications.

Course Outcomes:

1. Ability to write PL/SQL programs using loops, cursors, and exception handling to perform database operations.
2. Ability to create and use stored procedures, functions, and packages for modular and reusable database programming.
3. Ability to embed PL/SQL code in host languages like C and Java to develop complex database applications.
4. Ability to design and implement database triggers to automate business rules and data integrity.
5. Ability to perform data manipulation and retrieval efficiently using PL/SQL constructs.

List of Experiments:

1. Write a Pl/SQL program using FOR loop to insert ten rows into a database table.
2. Given the table EMPLOYEE (EmpNo, Name, Salary, Designation, DeptID), write a cursor to select the five highest paid employees from the table.
3. Illustrate how you can embed PL/SQL in a high-level host language such as C/Java And demonstrates how a banking debit transaction might be done.
4. Given an integer i, write a PL/SQL procedure to insert the tuple (i, 'xxx') into a given relation.
5. Write a PL/SQL program to demonstrate Exceptions.
6. Write a PL/SQL program to demonstrate Cursors.
7. Write a PL/SQL program to demonstrate Functions.
8. Write a PL/SQL program to demonstrate Packages.
9. Write PL/SQL queries to create Procedures.
10. Write PL/SQL queries to create Triggers.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS107PE: DEEP LEARNING LAB (LAB - II)

M. Tech CSE I Year I Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. Introduce the Python environment setup and usage of deep learning libraries such as Keras, TensorFlow, and PyTorch.
2. Develop practical skills in implementing Convolutional Neural Networks (CNN) for computer vision tasks.
3. Explore deep learning models for Natural Language Processing (NLP) applications including sentiment analysis.
4. Understand and apply advanced neural network architectures like RNNs, LSTMs, GRUs, autoencoders, and GANs.
5. Enable hands-on experience with training and evaluating deep learning models on real-world datasets.

Course Outcomes:

1. Ability to set up and utilize Python IDEs and deep learning libraries effectively for model development.
2. Ability to implement CNNs for image classification and computer vision problems.
3. Ability to design and train recurrent neural network models such as LSTM and GRU for NLP tasks like sentiment analysis.
4. Ability to apply autoencoders for data encoding and generative adversarial networks for image generation and unsupervised learning.
5. Ability to experiment with and analyze the performance of deep learning models on benchmark datasets.

LIST OF EXPERIMENTS:

1. Setting up the Spyder IDE Environment and Executing a Python Program
2. Installing Keras, Tensorflow and Pytorch libraries and making use of them
3. Applying the Convolution Neural Network on computer vision problems
4. Image classification on MNIST dataset (CNN model with Fully connected layer)
5. Applying the Deep Learning Models in the field of Natural Language Processing
6. Train a sentiment analysis model on IMDB dataset, use RNN layers with LSTM/GRU notes
7. Applying the Autoencoder algorithms for encoding the real-world data
8. Applying Generative Adversial Networks for image generation and unsupervised tasks.

TEXT BOOKS:

1. Deep Learning by Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press.
2. The Elements of Statistical Learning by T. Hastie, R. Tibshirani, and J. Friedman, Springer.
3. Probabilistic Graphical Models. Koller, and N. Friedman, MIT Press.

REFERENCES:

1. Bishop, C, M., Pattern Recognition and Machine Learning, Springer, 2006.
2. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
3. Golub, G.,H., and Van Loan, C.,F., Matrix Computations, JHU Press,2013.
4. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Extensive Reading:

1. http://www.deeplearning.net
2. https://www.deeplearningbook.org/
3. https://developers.google.com/machine-learning/crash-course/ml-intro
4. www.cs.toronto.edu/~fritz/absps/imagenet.pdf
5. http://neuralnetworksanddeeplearning.com/

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS109PE: NATURAL LANGUAGE PROCESSING LAB (LAB - II)

M. Tech CSE I Year I Sem.

L	T	P	C
0	0	4	2

Prerequisites: Data structures, finite automata and probability theory

Course Objectives:

1. Introduce fundamental natural language processing (NLP) tasks such as tokenization, stemming, and stopword removal.
2. Develop practical skills in word-level analysis and generation techniques.
3. Understand and apply syntactic processing methods including POS tagging, morphology, and chunking.
4. Implement n-gram models and smoothing techniques to handle language modeling challenges.

Course Outcomes:

1. Implement basic NLP preprocessing tasks such as tokenization, stemming, and stopword removal using Python.
2. Perform word-level analysis and generation techniques for text processing applications.
3. Apply syntactic processing methods including POS tagging, morphology, and chunking to analyze natural language structures.
4. Develop and evaluate n-gram models with smoothing techniques for language modeling tasks.
5. Design and implement end-to-end NLP pipelines for solving real-world text processing problems.

List of Experiments

Implement the following using Python

1. Tokenization
2. Stemming
3. Stop word removal (a, the, are,.)
4. Word Analysis
5. Word Generation
6. Pos tagging
7. Morphology
8. chunking
9. N-Grams
10. N-Grams Smoothing

TEXT BOOKS:

1. Multilingual natural Language Processing Applications: From Theory to Practice – Daniel M. Bikel and Imed Zitouni, Pearson Publication
2. Natural Language Processing and Information Retrieval: Tanvier Siddiqui, U.S. Tiwary

REFERENCES:

1. Speech and Natural Language Processing - Daniel Jurafsky & James H Martin, Pearson Publications

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS111PE: ADVANCED UNIX PROGRAMMING LAB (LAB - II)

M. Tech CSE I Year I Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. Provide hands-on experience with Linux utilities and shell environments.
2. Develop skills in writing shell scripts for automation of system tasks.
3. Familiarize students with UNIX system calls for file handling and process control.
4. Enable students to understand and implement process management, signals, and interprocess communication (IPC) mechanisms.
5. Introduce client-server communication concepts using sockets for distributed applications.

Course Outcomes:

1. Use Linux commands and text processing tools effectively for system administration.
2. Write shell scripts to automate tasks such as arithmetic operations, file management, and backups.
3. Implement file operations and process creation using C programs with UNIX system calls.
4. Demonstrate the use of signals, pipes, and message queues for interprocess communication.
5. Build simple client-server applications using TCP sockets for network communication.

List of Experiments

1. Practice session on basic **Linux utilities** (file handling, permissions, process utilities, disk utilities, networking commands, filters, and text processing) and use of **vi editor**.
2. Write **shell scripts** using bash to: (a) print factorial of n numbers, (b) generate multiplication table, (c) implement a simple calculator with +, –, ×, ÷ operations.
3. Write a **shell script** to automate **backup of files** from a given directory into a timestamped archive file.
4. Write a **C program** to demonstrate **file operations** using system calls: open, read, write, lseek, and close.
5. Write a **C program** to display file metadata (file type, size, number of links, last access time, permissions) using stat family of system calls.
6. Write a **C program** to create a child process using fork, replace the process image with an executable using exec, and illustrate **zombie and orphan processes**.
7. Write a **C program** to implement **signal handling** using signal(), kill(), and alarm() system calls.
8. Write a **C program** to demonstrate **Interprocess Communication using unnamed pipes** between parent and child processes.
9. Write a **C program** to implement **message queues** for client-server communication.
10. Write a **C program** using **sockets** to implement a simple **client-server application** (e.g., echo server) with TCP connection.

TEXT BOOKS:

5. Unix System Programming using C++, T. Chan, PHI.
6. Advanced Programming in the Unix Environment, 2nd edition, W. R. Stevens and S. A. Rago, Pearson Education.
7. Unix Concepts and Applications, 4th Edition, Sumitabha Das, TMH.
8. Unix Network Programming, W. R. Stevens, PHI.

REFERENCE BOOKS:

10. C Programming Language, Kernighan and Ritchie, PHI.
11. Beginning Linux Programming, 4th Edition, N. Matthew, R. Stones, Wrox, Wiley India Edition.
12. Unix for programmers and users, 3rd Edition, Graham Glass, King Ables, Pearson.
13. System Programming with C and Unix, A. Hoover, Pearson.
14. Unix System Programming, Communication, Concurrency and Threads, K. A. Robbins and S. Robbins, Pearson Education.
15. Unix shell Programming, S. G. Kochan and P. Wood, 3rd edition, Pearson Education.
16. Shell Scripting, S. Parker, Wiley India Pvt. Ltd.
17. Unix and Shell programming, B. A. Forouzan and R. F. Gilberg, Cengage Learning.
18. Linux System Programming, Robert Love, O'Reilly, SPD.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DVA101HS: RESEARCH METHODOLOGY & IPR

M. Tech CSE I Year I Sem.

L	T	P	C
2	0	0	2

Prerequisite: None

Course Objectives:

1. Understand the fundamentals of formulating and defining a research problem, including its scope and objectives.
2. Develop skills for effective literature review, analysis, and uphold research ethics to avoid plagiarism.
3. Gain proficiency in technical writing, preparing research proposals, and presenting research work effectively.
4. Learn the basics of Intellectual Property Rights (IPR), including patents, copyrights, designs, and trademarks.

Course Outcomes: At the end of this course, students will be able to

1. Ability to identify, formulate, and analyze research problems with clear objectives and scope.
2. Ability to conduct comprehensive literature studies ethically and critically.
3. Ability to prepare well-structured research proposals and technical reports for academic and professional presentation.
4. Ability to understand and apply the principles of Intellectual Property Rights, including patents and copyrights.
5. Ability to navigate the patenting process, manage IPR issues, and understand global perspectives on intellectual property.

UNIT-I

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT-II

Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT-III

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT-IV

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-V

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

TEXT BOOKS:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. C.R. Kothari, Research Methodology, methods & techniques, 2nd edition, New age International publishers

REFERENCES:

1. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
2. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
3. Mayall, "Industrial Design", McGraw Hill, 1992.

4. Niebel, “Product Design”, McGraw Hill, 1974.
5. Asimov, “Introduction to Design”, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
7. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC101HS: ENGLISH FOR RESEARCH PAPER WRITING

Prerequisite: None

Course objectives: Students will be able to:

- Understand that how to improve your writing skills and level of readability
- Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

UNIT-I:

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT-II:

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

UNIT-III:

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

UNIT-IV:

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

UNIT-V:

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions. useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

TEXT BOOKS/ REFERENCES:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC102HS:DISASTER MANAGEMENT (Audit Course - I)

Prerequisite: None

Course Objectives: Students will be able to

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches,
- planning and programming in different countries, particularly their home country or the countries they work in

UNIT-I:

Introduction:

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Disaster Prone Areas in India:

Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-II:

Repercussions of Disasters and Hazards:

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III:

Disaster Preparedness and Management:

Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-IV:

Risk Assessment Disaster Risk:

Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

UNIT-V:

Disaster Mitigation:

Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

TEXT BOOKS/ REFERENCES:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “’New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies”, Deep &Deep Publication Pvt. Ltd., New Delhi.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC103HS: SANSKRIT FOR TECHNICAL KNOWLEDGE

Prerequisite: None

Course Objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes: Students will be able to

- Understanding basic Sanskrit language
- Ancient Sanskrit literature about science & technology can be understood
- Being a logical language will help to develop logic in students

UNIT-I:

Alphabets in Sanskrit,

UNIT-II:

Past/Present/Future Tense, Simple Sentences

UNIT-III:

Order, Introduction of roots,

UNIT-IV:

Technical information about Sanskrit Literature

UNIT-V:

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TEXT BOOKS/ REFERENCES:

1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC104HS: VALUE EDUCATION (Audit Course - I)

Prerequisite: None

Course Objectives: Students will be able to

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character

Course outcomes: Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality

UNIT-I:

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements

UNIT-II:

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

UNIT-III:

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline, Punctuality, Love and Kindness.

UNIT-IV:

Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT-V:

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation, Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

TEXT BOOKS/ REFERENCES:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS216PC: ADVANCED ALGORITHMS (PC - III)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Pre-Requisites: UG level course in Algorithm Design and Analysis

Course Objectives:

1. Review and understand fundamental sorting algorithms and graph algorithms including shortest path and strongly connected components.
2. Learn the greedy paradigm with applications to matroids and graph matching algorithms such as Edmond's Blossom algorithm.
3. Study flow network algorithms including max-flow min-cut theorem and matrix computations including Strassen's algorithm and matrix decompositions.
4. Understand shortest path algorithms using dynamic programming and advanced numerical methods including the Chinese Remainder Theorem and Fast Fourier Transform.

Course Outcomes: After completion of course, students would be able to:

1. Ability to analyze and implement fundamental sorting and graph algorithms with correctness and efficiency considerations.
2. Ability to apply greedy algorithms to problems like matroids and graph matching, including maximum matching computation.
3. Ability to design and analyze flow-network algorithms and perform advanced matrix computations.
4. Ability to solve shortest path problems using dynamic programming and apply number theory and Fourier transform techniques in computations.
5. Ability to understand and apply linear programming methods and demonstrate knowledge of NP-completeness and computational complexity.

UNIT – I

Sorting:

Review of various sorting algorithms, topological sorting

Graph:

Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

UNIT – II

Matroids:

Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching:

Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

UNIT - III

Flow-Networks:

Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations:

Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

UNIT - IV

Shortest Path in Graphs:

Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Modulo Representation of integers/polynomials:

Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT):

In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.

UNIT - V

Linear Programming: Geometry of the feasibility region and Simplex algorithm
NP-completeness: Examples, proof of NP-hardness and NP-completeness.

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

REFERENCES:

1. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms".
2. Aho, Hopcroft, Ullman "The Design and Analysis of Computer Algorithms".
3. Kleinberg and Tardos."Algorithm Design".

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS218PC: ADVANCED COMPUTER ARCHITECTURE (PC - IV)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Computer Organization

Course Objectives:

1. Understand the fundamentals and theory of parallelism and different parallel computer models.
2. Learn principles of scalable performance, including performance metrics, speedup laws, and hardware technologies relevant to parallel processing.
3. Study shared-memory organizations, consistency models, and pipelining techniques in processor design.

Course Outcomes: Gain knowledge of

1. Demonstrate a comprehensive understanding of parallel computing concepts, parallel computer models, and architectural development.
2. Analyze and evaluate parallel system performance using speedup, scalability metrics, and hardware technology insights.
3. Design and explain processor pipeline architectures and shared memory consistency models.
4. Understand and apply concepts related to multiprocessor and multicomputer architectures, including interconnects and message-passing.
5. Apply vector processing principles and understand SIMD architectures in modern parallel computing systems.

UNIT - I

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

UNIT - II

Principles of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors

UNIT - III

Shared-Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

UNIT - IV

Parallel and Scalable Architectures, Multiprocessors and Multicomputers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputers, Message-passing Mechanisms, Multivetor and SIMD computers.

UNIT - V

Vector Processing Principles, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5.

TEXT BOOK:

1. Advanced Computer Architecture, Kai Hwang, 2nd Edition, Tata McGraw Hill Publishers.

REFERENCES:

1. Computer Architecture, J.L. Hennessy and D.A. Patterson, 4th Edition, ELSEVIER.
2. Advanced Computer Architectures, S.G.Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS219PE: ENTERPRISE CLOUD CONCEPTS (PROFESSIONAL ELECTIVE - III)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. Understand the origins, basic concepts, and terminology of cloud computing including its goals, benefits, risks, and challenges.
2. Learn about the enabling technologies of cloud computing such as broadband networks, data centers, and virtualization.

Course Outcomes:

1. Demonstrate knowledge of fundamental cloud computing concepts, models, and deployment strategies.
2. Analyze the underlying technologies that enable cloud computing including virtualization and data center technologies.
3. Evaluate cloud infrastructure and management mechanisms to support cloud-based services effectively.
4. Apply cloud architecture principles to design and understand cloud-enabled smart enterprises and enterprise transformations.
5. Understand the process and challenges involved in transitioning to cloud-centric enterprises and managing cloud contracts and IT infrastructures.

Unit - I

Understanding Cloud Computing:

Origins and influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges.

Fundamental Concepts and Models:

Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models.

Unit - II

Cloud-Enabling Technology:

Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology

CLOUD COMPUTING MECHANISMS:

Cloud Infrastructure Mechanisms: Logical Network Perimeter, Virtual Server, Cloud Storage Device, Cloud Usage Monitor, Resource Replication

Unit - III

Cloud Management Mechanisms: Remote Administration System, Resource Management System, SLA Management System, Billing Management System, Case Study Example

Cloud Computing Architecture

Fundamental Cloud Architectures: Workload Distribution Architecture, Resource Pooling Architecture, Dynamic Scalability Architecture, Elastic Resource Capacity Architecture, Service Load Balancing Architecture, Cloud Bursting Architecture, Elastic Disk Provisioning Architecture, Redundant Storage Architecture, Case Study Example

Unit - IV

Cloud-Enabled Smart Enterprises

Introduction, Revisiting the Enterprise Journey, Service-Oriented Enterprises, Cloud Enterprises, Smart Enterprises, The Enabling Mechanisms of Smart Enterprises

Cloud-Inspired Enterprise Transformations

Introduction, The Cloud Scheme for Enterprise Success, Elucidating the Evolving Cloud Idea, Implications of the Cloud on Enterprise Strategy, Establishing a Cloud-Incorporated Business Strategy

UNIT-V Transitioning to Cloud-Centric Enterprises

The Tuning Methodology, Contract Management in the Cloud

Cloud-Instigated IT Transformations

Introduction, Explaining Cloud Infrastructures, A Briefing on Next-Generation Services, Service Infrastructures, Cloud Infrastructures, Cloud Infrastructure Solutions, Clouds for Business Continuity, The Relevance of Private Clouds, The Emergence of Enterprise Clouds

TEXT BOOKS:

1. Erl Thomas, Puttini Ricardo, Mahmood Zaigham, Cloud Computing: Concepts, Technology & Architecture 1st Edition,
2. Pethuru Raj, Cloud Enterprise Architecture, CRC Press

REFERENCE:

1. James Bond, The Enterprise Cloud, O'Reilly Media, Inc.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS221PE: CYBER SECURITY (PROFESSIONAL ELECTIVE - III)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Course objectives:

1. Introduce the foundational concepts of cyber security, including threat types, vulnerabilities, and the CIA triad.
2. Explore cyber laws, regulations, and the role of cyber forensics in investigating cybercrime.
3. Understand the security challenges posed by mobile and wireless devices and organizational security policies.

Course Outcomes:

1. Demonstrate knowledge of cyber security concepts, threat types, and protective security layers.
2. Apply understanding of cyber laws and digital forensics to investigate and mitigate cyber incidents.
3. Evaluate security challenges in mobile and wireless computing and formulate organizational security policies accordingly.
4. Analyze the impact of cybercrime on organizations and address associated privacy and security risks effectively.
5. Critically assess data privacy issues and draw lessons from real-world cybercrime cases to strengthen cyber defense mechanisms.

UNIT -I

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

UNIT - II

Cyberspace and the Law & Cyber Forensics: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

UNIT - III

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

UNIT - V

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial, etc

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TEXT BOOKS:

1. Nina Godbole and Sunit Belpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley
2. B.B. Gupta, D.P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&FGroup.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS223PE: PARALLEL COMPUTING (PROFESSIONAL ELECTIVE - III)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites

1. Computer Organization & Architecture
2. Operating Systems
3. Programming for problem solving

Course Objectives

1. Introduce the fundamentals of parallel computing, including motivation, scope, and parallel programming platforms.
2. Develop understanding of principles and analytical modeling techniques for parallel algorithm design.
3. Learn programming models for parallelism such as Message Passing Interface (MPI) and shared address space programming (PThreads).

Course Outcomes

1. Understand the basic concepts, platforms, and communication operations in parallel computing.
2. Apply principles of parallel algorithm design and perform analytical modeling of parallel programs.
3. Write parallel programs using message passing and shared memory paradigms.
4. Implement and analyze parallel algorithms for matrix computations and sorting.
5. Design and implement parallel graph algorithms including MST, shortest path, and graph traversal techniques.

Unit I

Parallel Computing: Introduction, Motivation and scope - Parallel Programming Platforms – Basic Communication Operations

Unit II

Principles of Parallel Algorithm Design - Analytical Modelling of Parallel Programs

Unit III

Programming using Message Passing Paradigm (MPI) – Programming Shared Address Space Platforms (PThreads)

Unit IV

Dense Matric Algorithms (Matrix-Vector Multiplication, Matrix-Matrix Multiplication) – Sorting Algorithms (Issues, Bubble Sort, Quick Sort, Bucket Sort, Enumeration Sort, Radix Sort)

Unit V

Graph Algorithms (Minimum Spanning Tree: Prim's Algorithm - Single-Source Shortest Paths: Dijkstra's Algorithm) Search Algorithms (DFS, BFS)

TEXT BOOK:

1. Introduction to Parallel Computing, Second Edition, Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta, Addison-Wesley, 2003, ISBN: 0201648652

REFERENCES:

1. Parallel Computing – Theory and Practice, Second Edition, Michaek J. Quinn, Tata McGraw- Hill Edition.
2. Parallel Computers – Architectures and Programming, V. Rajaraman, C. Siva Ram Murthy, PHI.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS225PE: LARGE LANGUAGE MODELS (PROFESSIONAL ELECTIVE - III)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. To introduce the foundational concepts, architectures, and evolution of Large Language Models (LLMs).
2. To develop skills for training, fine-tuning, and optimizing LLMs for diverse applications.
3. To provide hands-on experience in prompt engineering and real-world LLM use cases.
4. To familiarize students with evaluation metrics, deployment strategies, and performance optimization techniques.

Course Outcomes (COs)

1. Understand the architecture and evolution of transformer-based LLMs and their pretraining objectives.
2. Implement tokenization, training, fine-tuning, and domain adaptation techniques for LLMs.
3. Design and apply effective prompts for various tasks such as text generation, summarization, and code generation.
4. Evaluate LLM performance using standard metrics, benchmarks, and human-centered evaluation methods.
5. Deploy and optimize LLMs for real-world scenarios considering scalability and latency challenges.

UNIT 1 – Foundations of Large Language Models

Introduction to LLMs: Definition, scope, and historical evolution from statistical NLP to transformers. The Transformer architecture: Attention mechanisms, self-attention, multi-head attention. Pretraining objectives: Masked language modeling (MLM), Causal language modeling (CLM). Evolution of LLMs: BERT, GPT series, T5, LLaMA, Mistral.

UNIT 2 – Training and Fine-Tuning LLMs

Pretraining datasets and tokenization: BPE, Sentence Piece, Word Piece. Fine-tuning approaches: Full fine-tuning, LoRA, adapters, instruction tuning. Domain adaptation and few-shot/zero-shot learning. Data augmentation for LLMs and prompt-based tuning.

UNIT 3 – Prompt Engineering and Applications

Principles of prompt design: Zero-shot, few-shot, and chain-of-thought prompting. System prompts, role prompting, and context length optimization.
Use cases: Text generation, summarization, code generation, question answering, chatbots. Tools & frameworks: Lang Chain, Llama Index, Hugging Face Transformers.

UNIT 4 – Evaluation and Deployment of LLMs

Evaluation metrics: Perplexity, BLEU, ROUGE, METEOR, human evaluation. Benchmark datasets: GLUE, SuperGLUE, HELM, BIG-bench.
Deployment strategies: API-based deployment, on-prem deployment, inference optimization. Scaling and latency considerations; quantization and pruning for LLMs.

UNIT 5 – Ethics, Safety, and Future Directions

Bias, fairness, and toxicity in LLMs. Hallucination problem and mitigation techniques. Legal and regulatory issues: Copyright, data privacy, AI Act. Trends in LLM research: Multimodal LLMs, retrieval-augmented generation (RAG), open-source LLM ecosystems.

TEXT BOOKS:

1. Vaswani, A. et al. (2017) *Attention Is All You Need* – NIPS Conference Paper.
2. Lewis, P. et al. (2021) *Language Models are Few-Shot Learners* – OpenAI Research Paper.
3. Tunstall, L., von Werra, L., & Wolf, T. (2022) *Natural Language Processing with Transformers* – O'Reilly Media.

REFERENCE BOOKS:

1. Bommasani, R. et al. (2021) *On the Opportunities and Risks of Foundation Models* – Stanford CRFM.
2. Jurafsky, D., & Martin, J. H. (2023) *Speech and Language Processing* (3rd Edition draft) – Pearson.
3. Mollick, E., & Mollick, L. (2024) *Co-Intelligence: Living and Working with AI* – Little, Brown Spark.
4. Hugging Face Documentation – *https://huggingface.co/docs/*

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS227PE: BIOINFORMATICS (PROFESSIONAL ELECTIVE - IV)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts of molecular biology, central dogma, and XML for bioinformatics data representation.
2. To develop programming skills using Perl/BioPerl for handling biological sequence data and analysis.
3. To provide knowledge of different database models and management systems for biological data storage and retrieval.

Course Outcomes:

1. Understand the central dogma of molecular biology and apply XML concepts for bioinformatics data representation.
2. Implement Perl/BioPerl programs to manipulate DNA and protein sequences for biological data processing.
3. Differentiate between various database models and design efficient database solutions for biological datasets.
4. Apply sequence alignment algorithms to analyze biological sequences and interpret alignment results.
5. Perform phylogenetic analysis using different methods and evaluate evolutionary relationships.

UNIT -I : The Central Dogma & XML (Bio XML) for Bioinformatics: Watson's definition, information flow, from data to knowledge, Convergence, the organization of DNA, the organization of Proteins, Introduction, Differences between HTML and XML, fundamentals of XML, fundamentals of XML namespaces. Introduction to DTDs, Document type Declarations, Declaring elements, declaring attributes, working with entities XML Schemas, Essential Concepts, working with simple types, working with complex types, Basic namespaces issues.

UNIT -II : Perl (Bioperl) for Bioinformatics: Representing sequence data, program to store a DNA sequence, concatenating DNA fragments, Transcription, Calculating the reverse complement in Perl, Proteins, files, reading proteins in files, Arrays, Flow control, finding motifs, counting Nucleotides, exploding strings into arrays, operating on strings, writing to files, subroutines and bugs.

UNIT -III : Databases: Flat file, Relational, object oriented databases, object Relational and Hypertext, Data life cycle, Database Technology, Database Architecture, Database Management Systems and Interfaces.

UNIT -IV : Sequence Alignment Algorithms: Biological motivations of sequence analysis, the models for sequence analysis and their biological motivation, global alignment, local alignment, End free-space alignment and gap penalty, Sequence Analysis tools and techniques.

UNIT -V : Phylogenetic Analysis: Introduction, methods of Phylogenetic analysis, distance methods, the neighbor- Joining (NJ) method, The Fitch/ Margoliash method, character-based methods, Other methods, Tree evaluation and problems in phylogenetic analysis, Clustering, Protein structure visualization and Protein structure prediction.

TEXT BOOKS:

1. S.C. Rastogi, N. Mendiratta, "Bioinformatics Methods and Applications", CBS publications, 2004
2. James D. Tisdall, "Beginning Perl for Bioinformatics" O'Reilly media, 1st Edition, 2001

REFERENCE BOOKS:

1. D.R. Westhead, J.H. Parish, "Bioinformatics" Viva books private limited, New Delhi (2003)
2. Att Wood, "Bioinformatics" Pearson Education, 2004
3. Bryan Bergeron, M.D, "Bioinformatics Computing" Pearson Education, 2003

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS228PE: ADHOC AND SENSOR NETWORKS (PROFESSIONAL ELECTIVE - IV)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Prerequisites: Computer Networks

Course Objectives

1. To introduce the fundamental concepts, characteristics, and challenges of Mobile Ad Hoc Networks (MANETs) and their applications.
2. To explain various routing protocols and algorithms used in MANETs, including proactive, reactive, hybrid, and position-based approaches.
3. To provide an understanding of data transmission techniques, multicasting, geocasting, and TCP performance over MANETs.

Course Outcomes

1. Understand the characteristics, challenges, and applications of MANETs and WSNs.
2. Analyze and compare different MANET routing algorithms, including topology-based and position-based techniques.
3. Evaluate data transmission issues such as broadcast storms, multicasting, and geocasting techniques.
4. Examine TCP behavior over MANETs and propose solutions to enhance TCP performance in dynamic networks.
5. Describe the architecture and lower-layer protocols of WSNs, including MAC, link, and routing layers.

UNIT - I

Introduction to Ad Hoc Networks

Characteristics of MANETs, Applications of MANETs and Challenges of MANETs. Routing in MANETs

Criteria for classification, Taxonomy of MANET routing algorithms, *Topology-based* routing algorithms-Proactive: DSDV, WRP; Reactive: DSR, AODV, TORA; Hybrid: ZRP; *Position- based* routing algorithms-Location Services-DREAM, Quorum-based, GLS; Forwarding Strategies

Greedy Packet, Restricted Directional Flooding-DREAM, LAR; Other routing algorithms-QoS Routing, CEDAR.

UNIT - II

Data Transmission

Broadcast Storm Problem, Rebroadcasting Schemes-Simple-flooding, Probability-based Methods, Area-based Methods, Neighbour Knowledge-based: SBA, Multipoint Relaying, AHBP. Multicasting: Tree-based: AMRIS, MAODV; Mesh-based: ODMRP, CAMP; Hybrid: AMRoute, MCEDAR.

UNIT - III

Geocasting

Data-transmission Oriented-LBM; Route Creation Oriented-GeoTORA, MGR**.**

TCP over Ad Hoc TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT - IV

Basics of Wireless Sensors and Lower Layer Issues

Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer, Routing Layer.

UNIT - V

Upper Layer Issues of WSN

Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

TEXT BOOKS:

1. Ad Hoc and Sensor Networks – Theory and Applications, *Carlos Corderio Dharma P.Aggarwal,* World Scientific Publications, March 2006, ISBN – 981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN – 978-1-55860-914-3 (Morgan Kauffman)

REFERENCES:

1. C. Siva Ram Murthy, B.S. ManojAd Hoc Wireless Networks: Architectures and Protocols
2. Taieb Znati Kazem Sohraby, Daniel Minoli, Wireless Sensor Networks: Technology, Protocols and Applications, Wiley.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS229PE: ROBOTIC PROCESS AUTOMATION (PROFESSIONAL ELECTIVE - IV)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts of Robotic Process Automation (RPA) and its real-world applications.
2. To familiarize students with the Automation Anywhere Enterprise platform and its advanced features.
3. To provide knowledge of Web Control Room and client components for efficient bot management.
4. To train students in bot creation, using recorders, task editors, variables, and command libraries.

Course Outcomes:

1. Understand the concepts of RPA, its importance, and use cases in various domains.
2. Explore the Automation Anywhere Enterprise platform and analyze its features and capabilities.
3. Manage bots, devices, workloads, and audit logs using Web Control Room and client interfaces.
4. Create and configure bots using recorders, task editors, and core automation commands.
5. Apply advanced commands for automation such as PDF integration, FTP, PGP, and error handling.

Unit I

Introduction to Robotic Process Automation & Bot Creation Introduction to RPA and Use cases – Automation Anywhere Enterprise Platform – Advanced features and capabilities – Ways to create Bots

Unit II

Web Control Room and Client Introduction - Features Panel - Dashboard (Home, Bots, Devices, Audit, Workload, Insights) - Features Panel – Activity (View Tasks in Progress and Scheduled Tasks)
- Bots (View Bots Uploaded and Credentials)

Unit III

Devices (View Development and Runtime Clients and Device Pools) - Workload (Queues and SLA Calculator) - Audit Log (View Activities Logged which are associated with Web CR) - Administration (Configure Settings, Users, Roles, License and Migration) - Demo of Exposed API's – Conclusion – Client introduction and Conclusion.

Unit IV

Bot Creator Introduction – Recorders – Smart Recorders – Web Recorders – Screen Recorders - Task Editor – Variables - Command Library – Loop Command – Excel Command – Database Command - String Operation Command - XML Command

Unit V

Terminal Emulator Command - PDF Integration Command - FTP Command - PGP Command - Object Cloning Command - Error Handling Command - Manage Windows Control Command - Workflow Designer - Report Designer

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath: Create Software robots. with the leading RPA tool – UiPath Kindle Edition.

REFERENCES:

1. Robotic Process Automation A Complete Guide - 2020 Edition Kindle Edition.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS230PE: GENERATIVE AI (PROFESSIONAL ELECTIVE - IV)

M. Tech CSE I Year II Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. To introduce the fundamentals of Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), Deep Learning (DL), and their role in generative modeling.
2. To explore advanced neural network architectures such as VAEs, GANs, Transformers, and transfer learning techniques for generative AI.
3. To develop skills in Large Language Models (LLMs), prompt engineering, and fine-tuning for real-world applications.
4. To provide knowledge of Multi-Agent Systems (MAS) and their integration with generative AI for collaborative and distributed tasks.

Course Outcomes

1. Understand the foundational concepts of AI, generative modeling, and their evolution across various domains.
2. Analyze and implement advanced neural architectures such as VAEs, GANs, LSTMs, and Transformers for generative AI tasks.
3. Design and fine-tune Large Language Models (LLMs) like GPT and BERT, and apply prompt engineering techniques for diverse applications.
4. Develop and deploy multi-agent systems that collaborate to perform complex generative AI tasks using modern tools and frameworks.
5. Apply frameworks like LangChain and RAG to build multimodal generative AI solutions across text, code, image, and video domains.

UNIT 1

Foundations of AI and Generative Models

Introduction and historical evolution to Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)and Deep Learning (DL), Structure of Artificial Neural Networks (ANNs), Mathematical and computational foundations of generative modeling, Overview of generative models and their applications across various domains; Importance of Generative AI in modern applications, Transfer learning and in advancing Generative AI

UNIT 2

Advanced Neural Architectures for Generative AI

Variational Autoencoders (VAEs): principles and applications, Generative Adversarial Networks (GANs): architecture and working principles; Transformer architecture and attention mechanisms (in detail); Long Short-Term Memory Networks (LSTMs) and the limitations of traditional RNNs/LSTMs, Advanced Transformer architectures and techniques, Pre-training and transfer learning strategies for generative models

UNIT 3

Large Language Models and Prompt Engineering

Overview of Large Language Models (LLMs), GPT architecture, variants, and working principles, Pré- training and fine-tuning GPT models for applications (e.g., chatbots, text generation), Case study: GPT-based customer support chatbot, BERT architecture, pre-training objectives, and fine-tuning, Prompt Engineering: Designing effective prompts, controlling model behavior, and improving output quality, Fine-tuning language models for creative writing and chatbot development

UNIT 4

Multi-Agent Systems and Generative AI Applications

Introduction to Multi-Agent Systems (MAS),Types of agents: reactive, deliberative, hybrid, and learning agents, Multi-agent collaboration and orchestration for generative tasks, Use cases: autonomous research assistants, cooperative creative generation, distributed problem-solving, Frameworks and tools: AutoGen, CrewAI, Hugging GPT for LLM-powered multi-agent systems, Generative AI applications: Art, Creativity, Image/Video generation, Music composition, Healthcare, Finance, Real-world case studies and deployment challenges

UNIT 5

Frameworks, Multimodal Applications, and Ethics

LangChain framework: components and LLM application development, Retrieval-Augmented Generation (RAG), Embeddings, Indexing networks, and Vector databases, Generative AI across modalities: Text, Code, Image, and Video generation, Image and Video generation using GANs and

VAEs, Multimodal Generative AI: integration and training strategies, Ethical considerations: bias, fairness, trust, and responsible AI deployment, Social and legal implications of Generative AI, Risk mitigation strategies and real-world ethical case studies

TEXT BOOKS

1. Altaf Rehmani, Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology.
2. Charu C. Aggarwal, Neural Networks and Deep Learning: A Textbook. Joseph Babcock, Raghav Bali, Generative AI with Python and TensorFlow 2, 2024.

REFERENCE BOOKS

1. Josh Kalin, Generative Adversarial Networks Cookbook.
2. Jesse Sprinter, Generative AI in Software Development: Beyond the Limitations of Traditional Coding, 2024.

ONLINE REFERENCES

1. Fabian Gloeckle et al., Better & Faster Large Language Models via Multi-token Prediction, arXiv:2404.19737v1, 2024.Vaswani et al., Attention Is All You Need, NeurIPS 2017.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS217PC: ADVANCED ALGORITHMS LAB (LAB - III)

M. Tech CSE I Year II Sem.

L	T	P	C
0	0	4	2

Course Objective:

1. To provide practical exposure to implementing classical algorithms for problem-solving.
2. To develop the ability to **apply algorithmic techniques** such as brute force, divide and conquer, greedy methods, and dynamic programming.
3. To enhance problem-solving skills using **string matching, graph algorithms**, and optimization techniques.

Course Outcomes:

1. Implement brute force algorithms to solve optimization problems like the assignment problem.
2. Apply divide and conquer strategies to solve problems such as long integer multiplication.
3. Solve optimization problems like the knapsack problem using the greedy method.
4. Perform Gaussian elimination and LU decomposition for solving linear equations.
5. Implement Warshall's algorithm for transitive closure of graphs.

List of Experiments

1. Implement assignment problem using Brute Force method
2. Perform multiplication of long integers using divide and conquer method.
3. Implement a solution for the knapsack problem using the Greedy method.
4. Implement Gaussian elimination method.
5. Implement LU decomposition
6. Implement Warshall algorithm
7. Implement the Rabin Karp algorithm.
8. Implement the KMP algorithm.
9. Implement Harspool algorithm
10. Implement max-flow problem.

TEXT BOOK:

1. Design and Analysis of Algorithms, S.Sridhar, OXFORD University Press

REFERENCES:

1. Introduction to Algorithms, second edition, T.H. Cormen, C.E. Leiserson, R.L. Rivest and C.Stein,PHI Pvt. Ltd./ Pearson Education.
2. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Universities Press.
3. Design and Analysis of algorithms, Aho, Ullman and Hopcroft, Pearson education.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS220PE: ENTERPRISE CLOUD CONCEPTS LAB (LAB -IV)

M. Tech CSE I Year II Sem.

L	T	P	C
0	0	4	2

Course Objectives:

1. To introduce students to virtualization tools like VirtualBox/VMware and enable them to set up multiple operating systems.
2. To provide hands-on experience in installing compilers and running basic programs within virtualized environments.
3. To develop skills in cloud application deployment using platforms like Google App Engine.
4. To teach procedures for file sharing and networking between virtual machines.

Course Outcomes:

1. Install and configure different operating systems using virtualization software such as VirtualBox or VMware.
2. Set up a C compiler in a virtual environment and execute basic programs successfully.
3. Deploy and manage simple web applications using cloud platforms like Google App Engine.
4. Perform file transfer operations between virtual machines using standard networking techniques.
5. Launch and operate virtual machines using online OpenStack demo environments like TryStack.

List of Experiments:

6. Install Virtualbox/VMware Workstation with different flavors of linux or windows OS on top of windows7 or 8.
7. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
8. Install Google App Engine. Create a hello world app and other simple web applications using python/java..
9. Find a procedure to transfer the files from one virtual machine to another virtual machine.
10. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
11. Install Hadoop single node cluster and run simple applications like word count.

E-Resources:

1. https://www.iitk.ac.in/nt/faq/vbox.htm

2. https://www.google.com/urlsa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjqrNG0za73AhXZt1YBHZ21DWEQFnoECAMQAQ&url=http%3A%2F%2Fwww.cs.columbia.edu%2F~sedwards%2Fclasses%2F2015%2F1102-fall%2Flinuxvm.pdf&usg=AOvVaw3xZPuF5xVgk-AQnBRsTtHz

3. https://www.cloudsimtutorials.online/cloudsim/ 4.https://edwardsamuel.wordpress.com/2014/10/25/tutorial-creating-openstack-instance-in-trystack/

5. https://www.edureka.co/blog/install-hadoop-single-node-hadoop-cluster

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS222PE: CYBER SECURITY LAB (LAB -IV)

M. Tech CSE I Year II Sem.

L	T	P	C
0	0	4	2

Prerequisites

1. A course on "Network Security and Cryptography".

Course Objectives:

1. To introduce students to cybersecurity tools and techniques for analyzing and securing networks.
2. To provide hands-on experience in cryptographic algorithms, password generation, and digital signatures.
3. To develop skills in network monitoring and traffic analysis using sniffers and intrusion detection systems.

Course Outcomes:

1. Perform port scanning and identify open services using tools like NMAP.
2. Configure and monitor honeypots to detect malicious network activity.
3. Implement and demonstrate symmetric, asymmetric cryptography, hashing, and PKI signatures using tools like Jcrypt or Cryptool.
4. Apply digital forensics techniques including email, registry, memory, and file type analysis using tools like Autopsy and FTK Imager.
5. Design, configure, and evaluate end-to-end cybersecurity solutions by integrating cryptography, network monitoring, and forensic tools for real-world applications.

List of Experiments

1. Perform an Experiment for port scanning with NMAP.
2. Setup a honeypot and monitor the honeypot on the network
3. Install Jcrpt /Cryptool tool (or any other equivalent) and demonstrate Asymmetric, Symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using open SSL command
5. Perform practical approach to implement Foot printing-Gathering target information using Dmitry-Dmagic, UAtester.
6. Working with sniffers for monitoring network communication (Wireshark).
7. Use Snort to perform real time traffic analysis and packet logging.
8. Perform email analysis using Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10. Perform File type detection using Autopsy tool
11. Perform Memory capture and analysis using FTK imager tool
12. Perform Network analysis using the Network Miner tool

TEXT BOOKS

1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerback Publications, 2013.
2. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010

REFERENCES:

1. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H. Malin, E. Casey and J. M. Aquilina, Syngress, 2012
3. The Best Damn Cybercrime and Digital Forensics Book Period, J. Wiles and A.Reyes, Syngress, 2007.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS224PE: PARALLEL COMPUTING LAB (LAB -IV)

M. Tech CSE I Year II Sem.

L	T	P	C
0	0	4	2

Prerequisites

1. Computer Organization & Architecture
2. Operating Systems
3. Programming for problem solving

Course Objectives

1. To introduce students to the concepts and tools of parallel programming using MPI, OpenMP, and Pthreads.
2. To develop skills for designing and implementing parallel algorithms for computational and graph-based problems.
3. To provide hands-on experience in optimizing algorithms for performance and scalability in a parallel computing environment.

Course Outcomes

1. Implement matrix-vector and matrix-matrix multiplication using MPI for distributed systems.
2. Design and execute parallel sorting algorithms like Bubble Sort, Quick Sort, and Bucket Sort using OpenMP and Pthreads.
3. Apply parallel programming constructs to implement graph algorithms such as Prim's, DFS, BFS, and Dijkstra's algorithms.
4. Compare and analyze the performance of parallel algorithms against their sequential counterparts.
5. Demonstrate proficiency in using MPI, OpenMP, and Pthreads for real-world parallel computing tasks.

List of Programs:

1. Design a parallel program to implement Matrix-Vector and Matrix-Matrix Multiplication using MPI library.
2. Design a parallel program to implement Bubble Sort using OpenMP and Pthread Programming Constructs.
3. Design a parallel program to implement Quick Sort using OpenMP and Pthread Programming Constructs.
4. Design a parallel program to implement Bucket Sort using OpenMP and Pthread Programming Constructs.
5. Design a parallel program to implement Prim's Algorithm using OpenMP and Pthread Programming Constructs.
6. Design a parallel program to implement DFS Algorithm using OpenMP and Pthread Programming Constructs.
7. Design a parallel program to implement BFS Algorithm using OpenMP and Pthread Programming Constructs.
8. Design a parallel program to implement Dijkstra's Algorithm using MPI library.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC205HS: CONSTITUTION OF INDIA (Audit Course - II)

Prerequisite: None

Course Objectives: Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I:

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working),
Philosophy of the Indian Constitution: Preamble**,** Salient Features.

UNIT-II:

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality**,** Right to Freedom**,** Right against Exploitation**,** Right to Freedom of Religion**,** Cultural and Educational Rights**,** Right to Constitutional Remedies, Directive Principles of State Policy**,** Fundamental Duties.

UNIT-III:

Organs of Governance: Parliament**,** Composition**,** Qualifications and Disqualifications**,** Powers and Functions**,** Executive**,** President**,** Governor**,** Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

UNIT-IV:

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V:

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

TEXT BOOKS/ REFERENCES:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC206HS: PEDAGOGY STUDIES (Audit Course - II)

Prerequisite: None

Course Objectives: Students will be able to:

- Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

Course Outcomes: Students will be able to understand:

- What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

UNIT-I:

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

UNIT-II:

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

UNIT-III:

Evidence on the effectiveness of pedagogical practices, Methodology for the indepth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the scho curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT-IV:

Professional development: alignment with classroom practices and follow-up support, Peer support, Support from the head teacher and the community. Curriculum and assessment, Barriers to learning: limited resources and large class sizes

UNIT-V:

Research gaps and future directions: Research design**,** Contexts**,** Pedagogy**,** Teacher education**,** Curriculum and assessment**,** Dissemination and research impact.

TEXT BOOKS/ REFERENCES:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC207HS: STRESS MANAGEMENT BY YOGA (Audit Course -II)

Prerequisite: None

Course Objectives:

- To achieve overall health of body and mind
- To overcome stress

Course Outcomes: Students will be able to:

- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

UNIT-I:

Definitions of Eight parts of yog. (Ashtanga)

UNIT-II:

Yam and Niyam.

UNIT-III:

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT-IV:

Asan and Pranayam

UNIT-V:

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

TEXT BOOKS/ REFERENCES:

1. 'Yogic Asanas for Group Tarining-Part-I": Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

(UGC-AUTONOMOUS)

M.Tech. in COMPUTER SCIENCE AND ENGINEERING

(Applicable from AY 2025-26 Batch)

25DAC208HS:**PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS**

(Audit Course - II)

Prerequisite: None

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

Course Outcomes: Students will be able to

- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neetishatakam will help in developing versatile personality of students

UNIT-I:

Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)

UNIT-II:

Neetisatakam-Holistic development of personality

- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

UNIT-III:

Approach to day to day work and duties.

- Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

UNIT-IV:

Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:

UNIT-V:

- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

TEXT BOOKS/ REFERENCES:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS331PE: DIGITAL FORENSICS (PROFESSIONAL ELECTIVE - V)

M. Tech CSE II Year I Sem.

L	T	P	C
3	0	0	3

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:

1. To provide an in-depth study of the rapidly changing and fascinating field of computer forensics.
2. To combine both the technical expertise and knowledge required to investigate, detect, and prevent digital crimes.
3. To impart knowledge on digital forensics legislations, digital crime, forensic processes and procedures, data acquisition and validation, and e-discovery tools.
4. To understand e-evidence collection and preservation, investigation of operating systems and file systems, network forensics, steganography, and mobile device forensics.

Course Outcomes: On completion of the course the student should be able to

1. Understand relevant legislation and codes of ethics related to digital forensics.
2. Explain computer forensics concepts, digital detective roles, and various processes, policies, and procedures.
3. Apply e-discovery tools, guidelines, and standards for handling electronic evidence.
4. Analyze email, web, and network forensic data to support digital investigations.
5. Evaluate and apply mobile device forensic techniques, steganography methods, and recent trends in digital forensics to real-world case studies.

UNIT - I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

UNIT - II

Cyber Crime Scene Analysis:
Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT - III

Evidence Management & Presentation:
Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT - IV

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, **Network Forensics:** open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V

Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

TEXT BOOKS:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

REFERENCES:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN : 1838648178.
2. Thomas J. Holt , Adam M. Bossler, Kathryn C. Seigfried-Spellar , Cybercrime and Digital Forensics: An Introduction, Routledge.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS332PE: ADVANCED OPERATING SYSTEMS (PROFESSIONAL ELECTIVE - V)

M. Tech CSE II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. To introduce the architectures and theoretical foundations of distributed systems and operating systems.
2. To study distributed algorithms for mutual exclusion, deadlock detection, and resolution in distributed environments.
3. To provide knowledge of multiprocessor system architectures, operating systems, and distributed file systems.
4. To understand load distribution, scheduling, and task migration in distributed computing systems.

Course Outcomes

1. Understand the principles, architectures, and communication primitives of distributed systems.
2. Apply algorithms for distributed mutual exclusion using token-based and non-token-based methods.
3. Analyze and implement techniques for distributed deadlock detection and resolution.
4. Describe multiprocessor system architectures, design issues, and mechanisms for building distributed file systems.
5. Evaluate load distribution algorithms and task migration techniques for system performance improvement.

UNIT - I

Architectures of Distributed Systems: System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. Theoretical Foundations: Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

UNIT - II

Distributed Mutual Exclusion: The Classification of Mutual Exclusion Algorithms, Non-Token –
Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, Token-Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heurisric Algorithm, Raymond's Heuristic Algorithm.

UNIT - III

Distributed Deadlock Detection: Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized-Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

UNIT - IV

Multiprocessor System Architectures: Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling.
Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

UNIT - V

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues

TEXT BOOK:

1. Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjan G. Shivaratri, Tata McGraw-Hill Edition 2001.

REFERENCE BOOK:

1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS333PE: QUANTUM COMPUTING (PROFESSIONAL ELECTIVE - V)

M. Tech CSE II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. To introduce the foundational mathematics, including linear algebra, complex numbers, and vector spaces, essential for understanding quantum computing.
2. To explain the basic principles of quantum physics and quantum theory required to understand qubits and quantum states.
3. To study quantum architectures, qubit design, quantum gates, circuits, and modern quantum hardware technologies.

Course Outcomes

1. Understand the mathematical foundations required for quantum computing, including matrices, complex numbers, and vector spaces.
2. Explain basic concepts of quantum mechanics such as quantum states, entanglement, and decoherence.
3. Describe quantum architectures, gates, circuits, and qubit implementation in modern hardware.
4. Apply and analyze fundamental quantum algorithms like Shor's and Grover's algorithms for computational problems.
5. Evaluate the vulnerabilities of current asymmetric cryptographic algorithms under quantum computing attacks.

Unit I

Introduction to Essential Linear Algebra

Some Basic Algebra, Matrix Math, Vectors and Vector Spaces, Set Theory

Complex Numbers

Definition of Complex Numbers, Algebra of Complex Numbers, Complex Numbers Graphically, Vector Representations of Complex Numbers, Pauli Matrice, Transcendental Numbers

Unit II

Basic Physics for Quantum Computing

The Journey to Quantum, Quantum Physics Essentials, Basic Atomic Structure, Hilbert Spaces, Uncertainty, Quantum States, Entanglement

Basic Quantum Theory

Further with Quantum Mechanics, Quantum Decoherence, Quantum Electrodynamics, Quantum Chromodynamics, Feynman Diagram Quantum Entanglement and QKD, Quantum Entanglement, Interpretation, QKE

Unit III

Quantum Architecture

Further with Qubits, Quantum Gates, More with Gates, Quantum Circuits, The D-Wave Quantum Architecture

Quantum Hardware

Qubits, How Many Qubits Are Needed? Addressing Decoherence, Topological Quantum Computing, Quantum Essentials

Unit IV

Quantum Algorithms

What Is an Algorithm? Deutsch's Algorithm, Deutsch-Jozsa Algorithm, Bernstein-Vazirani Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm

Unit V

Current Asymmetric Algorithms: RSA, Diffie-Hellman, Elliptic Curve

The Impact of Quantum Computing on Cryptography: Asymmetric Cryptography, Specific Algorithms, Specific Applications.

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press
2. Dr. Chuck Easttom, Quantum Computing Fundamentals, Pearson

REFERENCES:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. Basic Concepts, Vol
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

25DCS334PE: PROMPT ENGINEERING (PROFESSIONAL ELECTIVE - V)

M. Tech CSE II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the fundamentals and principles of prompt engineering and their role in effective communication with large language models (LLMs).
2. To provide a comprehensive understanding of LLM architectures, including GPT, Gemini, LLaMA, and other open-source models.
3. To develop skills in standard practices for text generation, including structured formats like JSON, YAML, and CSV.
4. To explore advanced text processing techniques, such as chunking, tokenization, and managing large text datasets.

Course Outcomes:

1. Understand the core principles of prompt engineering and apply them to generate accurate and meaningful outputs.
2. Explain the architecture and working of various large language models and their evolution.
3. Implement standard practices for generating structured and unstructured text using LLMs like ChatGPT.
4. Apply chunking and tokenization strategies to process and manage large volumes of text efficiently.
5. Utilize FAISS and Pinecone for embedding storage and retrieval in LLM-powered systems.

UNIT – I

Fundamentals and Principles of Prompting

Overview of the Five Principles of Prompting: Give Direction, Specify Format, Provide Examples, Evaluate Quality, Divide Labor.

UNIT – II

Introduction to Large Language Models for Text Generation

What Are Text Generation Models, Vector Representations: The Numerical Essence of Language, Transformer Architecture: Orchestrating Contextual Relationships, Probabilistic Text Generation: The Decision Mechanism, Historical Underpinnings: The Rise of Transformer Architectures, OpenAI's Generative Pretrained Transformers, GPT-3.5-turbo and ChatGPT, GPT-4, Google's Gemini, Meta's Llama and Open Source.

UNIT – III

Standard Practices for Text Generation with ChatGPT- Part-A

Generating Lists, Hierarchical List Generation, When to Avoid Using Regular Expressions, Generating JSON, YAML Filtering YAML Payloads, Handling Invalid Payloads in YAML, Diverse Format Generation with ChatGPT, Mock CSV Data, Universal Translation Through LLMs, Ask for Context, Text Style Unbundling, Identifying the Desired Textual Features, Generating New Content with the Extracted Features, Extracting Specific Textual Features with LLMs.

UNIT – IV

Standard Practices for Text Generation with ChatGPT- Part-B

Chunking Text, Benefits of Chunking Text, Scenarios for Chunking Text, Poor Chunking Example, Chunking Strategies, Sentence Detection Using SpaCy, building a Simple Chunking Algorithm in Python, Sliding Window Chunking, Text Chunking Packages, Text Chunking with Tiktoken, Encodings, Understanding the Tokenization of Strings.

UNIT – V

Vector Databases with FAISS and Pinecone

Retrieval Augmented Generation (RAG), Introducing Embeddings, Document Loading

Memory Retrieval with FAISS, RAG with Lang Chain, Hosted Vector Databases with Pinecone, Self- Querying, Alternative Retrieval Mechanisms.

TEXTBOOK:

1. Phoenix J, Taylor M. Prompt engineering for generative AI. " O'Reilly Media, Inc."; 2024 May 16.

REFERENCES:

1. Tunstall L, Von Werra L, Wolf T. Natural language processing with transformers. " O'Reilly Media, Inc."; 2022 Jan 26.
2. Foster D. Generative deep learning. " O'Reilly Media, Inc."; 2022 Jun 28.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE
(UGC-AUTONOMOUS)

25DMS301OE: ENTREPRENEURSHIP

M.Tech. II Year I Semester

L	T	P	C
3	0	0	3

Course Outcomes: At the end course, one should be able

- To assess the commercial viability of a new technology-based idea. The candidate can usevarious methods and tools for this purpose.
- To transform research-based ideas into feasibility and business plans. The candidate can use (tacitand explicit) methods and tools for this purpose.
- To present new ideas to the market.
- To assess the need for innovation, initiate the process and run innovations in organizations.
- To seize opportunities, organize and finance viable initiatives through to fruition.

UNIT- I

Nature of Entrepreneurship: Essential features, attitude and leadership of entrepreneur characteristics, qualities and skills, functions of entrepreneur, entrepreneur scenario in Indian economy, types of ownership, sole trading, partnership, joint stock company, important features of various types of businesses, corporate entrepreneurship, entrepreneurship, role of government in the promotion of entrepreneur, state enterprises in India.

UNIT- II

Aspects of Promotion: Opportunity analysis, SWOT analysis, internal and external environment analysis, technological competitiveness, entrepreneurs and legal regulatory systems, patents and trademarks, intellectual property rights, project planning.

Feasibility studies: The concept of project, project life cycle, project planning, feasibility, SWOT analysis,product and process development, major steps in product development.

UNIT- III

Financial Aspect of the Entrepreneurship: Source of capital, debit equity financing commercial banks, bank loans, assessment of benefits and costs, informal agencies in financing entrepreneurs, government grants and subsidies, types of investors and private offerings.

UNIT- IV

Entrepreneurial Strategy: Generation of new entry opportunity, decisions under uncertainty, entry strategy, new entry exploitation, environmental instability and first mover disadvantages, risk reduction strategies, market scope strategy, imitation strategies and managing newness.

UNIT- V

Women Entrepreneurship: Introduction, the dynamic need, entrepreneurship in a developing economy, the scope of entrepreneurship among women, promotional efforts supporting women entrepreneurs in India, issues of employment generation, rural entrepreneurship and EDPs: Need, rural industrialization, NGOs and rural entrepreneurship, need for EDPs, objectives of EDPs course contents and curriculum of EDPs, Phases of EDPs & evaluation of EDPs.

REFERENCE BOOKS:

1. Madhurimal ali, Shikhasahai, entrepreneurship, Excel books, first edition, New Delhi, 2006.
2. Nandan H, fundamentals of entrepreneurship, PHI New Delhi, 2009

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE
(UGC-AUTONOMOUS)

25DEE301PE:INTRODUCTION TO FUZZY LOGIC AND NEURAL NETWORKS

M.Tech. II Year I Semester

L	T	P	C
3	0	0	3

Course Objectives:

- To introduce the basics of Neural Networks and its architectures.
- To introduce the Fuzzy sets and Fuzzy Logic system components
- To deal with the applications of Neural Networks and Fuzzy systems

Course Outcomes: After completion of this course, the students are able

- To understand artificial neural network models and their training algorithms
- To understand the concept of fuzzy logic system components, fuzzification and defuzzification
- Apply the above concepts to real-world problems and applications.

UNIT – I

Introduction To Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT – II

FeedForward Neural Networks: Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT - III

Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules,

Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory).
Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem.
Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT – IV

Classical and Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT – V

Fuzzy Logic System: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Text Books:

1. Rajasekharan and Pai, Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications– PHI Publication, 1st Edition, 1905
2. Satish Kumar, Neural Networks, TMH, 2004.

Reference Books:

1. “James A Freeman and Davis Skapura”, Neural Networks, Pearson Education, 2002.
2. “Simon Hakins”, Neural Networks, Pearson Education, 3rd Edition 2008.
3. C. Eliasmith and Ch. Anderson, Neural Engineering, PHI, 2004.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE
(UGC-AUTONOMOUS)

25DEC301OE: VLSI DESIGN

M.Tech. II Year I Semester

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to:

1. Give exposure to different steps involved in the fabrication of ICs.
2. Explain electrical properties of MOS and BiCMOS devices to analyze the behavior of invertersdesigned with various loads.
3. Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4. Provide design concepts to design building blocks of data path of any system using gates.
5. Understand basic programmable logic devices and testing of CMOS circuits.

Course Outcomes: Upon completing this course, the student will be able to

1. Acquire qualitative knowledge about the fabrication process of integrated circuits using MOStransistors.
2. Draw the layout of any logic circuit which helps to understand and estimate parasitic effect ofany logic circuit
3. Design building blocks of data path systems, memories and simple logic circuits using PLA,PAL, FPGA and CPLD.
4. Understand different types of faults that can occur in a system and learn the concept of testingand adding extra hardware to improve testability of system.

UNIT – I

Introduction: Introduction to IC Technology – MOS, PMOS, NMOS, CMOS & BiCMOS

Basic Electrical Properties: Basic Electrical Properties of MOS and BiCMOS Circuits: Ids-Vds relationships, MOS transistor threshold Voltage, gm, gds, Figure of merit; Pass transistor, NMOS Inverter, Various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters.

UNIT - II

VLSI Circuit Design Processes: VLSI Design Flow, MOS Layers, Stick Diagrams, Design Rules and Layout, Transistors Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits.

UNIT – III

Gate Level Design: Logic Gates and Other complex gates, Switch logic, Alternate gate circuits, Time delays, Driving large capacitive loads, Wiring capacitance, Fan – in, Fan – out.

UNIT - IV

Data Path Subsystems: Subsystem Design, Shifters, Adders, ALUs, Multipliers, Parity generators, Comparators, Zero/One Detectors, Counters.

Array Subsystems: SRAM, DRAM, ROM, Serial Access Memories.

UNIT - V

Programmable Logic Devices: Design Approach – PLA, PAL, Standard Cells FPGAs, CPLDs.

CMOS Testing: CMOS Testing, Test Principles, Design Strategies for test, Chip level Test Techniques.

TEXT BOOKS:

1. Essentials of VLSI circuits and systems – Kamran Eshraghian, Eshraghian Dougles and A.Pucknell, PHI, 2005 Edition
2. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris,Ayan Banerjee, 3rd Ed, Pearson, 2009.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011
2. CMOS logic circuit Design - John. P. Uyemura, Springer, 2007.
3. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
4. VLSI Design- K. Lal Kishore, V. S. V. Prabhakar, I.K International, 2009.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

GENERATIVE AI (OPEN ELECTIVE)

M.Tech CSE II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives

1. To introduce the foundations of Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP), and Deep Learning (DL) with a focus on Generative AI.
2. To understand advanced neural architectures such as VAEs, GANs, Transformers, and their role in generative model development.
3. To explore Large Language Models (LLMs) and Prompt Engineering for text generation and real-world applications.
4. To study multi-agent systems and their collaboration in solving complex generative AI tasks.

Course Outcomes

1. Explain the fundamentals of AI, ML, NLP, and DL, and describe the foundations of generative modeling.
2. Analyze advanced neural architectures like VAEs, GANs, Transformers, and their applications.
3. Apply prompt engineering techniques and fine-tune LLMs for specific tasks such as chatbot development and creative writing.
4. Demonstrate the use of multi-agent systems and frameworks like AutoGen and CrewAI for generative tasks.
5. **Evaluate** ethical, social, and legal challenges associated with Generative AI and propose risk mitigation strategies.

UNIT 1

Foundations of AI and Generative Models

Introduction and historical evolution to Artificial Intelligence (AI), Machine Learning (ML), Natural Language Processing (NLP)and Deep Learning (DL), Structure of Artificial Neural Networks (ANNs), Mathematical and computational foundations of generative modeling, Overview of generative models and their applications across various domains; Importance of Generative AI in modern applications, Transfer learning and in advancing Generative AI

UNIT 2

Advanced Neural Architectures for Generative AI

Variational Autoencoders (VAEs): principles and applications, Generative Adversarial Networks (GANs): architecture and working principles; Transformer architecture and attention mechanisms (in detail); Long Short-Term Memory Networks (LSTMs) and the limitations of traditional RNNs/LSTMs, Advanced Transformer architectures and techniques, Pre-training and transfer learning strategies for generative models

UNIT 3

Large Language Models and Prompt Engineering

Overview of Large Language Models (LLMs), GPT architecture, variants, and working principles, Pré- training and fine-tuning GPT models for applications (e.g., chatbots, text generation), Case study: GPT-based customer support chatbot, BERT architecture, pre-training objectives, and fine-tuning, Prompt Engineering: Designing effective prompts, controlling model behavior, and improving output quality, Fine-tuning language models for creative writing and chatbot development

UNIT 4

Multi-Agent Systems and Generative AI Applications

Introduction to Multi-Agent Systems (MAS),Types of agents: reactive, deliberative, hybrid, and learning agents, Multi-agent collaboration and orchestration for generative tasks, Use cases: autonomous research assistants, cooperative creative generation, distributed problem-solving, Frameworks and tools: AutoGen, CrewAI, Hugging GPT for LLM-powered multi-agent systems, Generative AI applications: Art, Creativity, Image/Video generation, Music composition, Healthcare, Finance, Real-world case studies and deployment challenges

UNIT 5

Frameworks, Multimodal Applications, and Ethics

LangChain framework: components and LLM application development, Retrieval-Augmented Generation (RAG), Embeddings, Indexing networks, and Vector databases, Generative AI across modalities: Text, Code, Image, and Video generation, Image and Video generation using GANs and VAEs, Multimodal Generative AI: integration and training strategies, Ethical considerations: bias,

fairness, trust, and responsible AI deployment, Social and legal implications of Generative AI, Risk mitigation strategies and real-world ethical case studies

TEXT BOOKS:

1. Altaf Rehmani, *Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology*.
2. Charu C. Aggarwal, *Neural Networks and Deep Learning: A Textbook*.Joseph Babcock, Raghav Bali, *Generative AI with Python and TensorFlow 2*, 2024.

REFERENCE BOOKS:

1. Josh Kalin, Generative Adversarial Networks Cookbook.
2. Jesse Sprinter, Generative AI in Software Development: Beyond the Limitations of Traditional Coding, 2024.

ONLINE REFERENCES:

1. Fabian Gloeckle et al., Better & Faster Large Language Models via Multi-token Prediction, arXiv:2404.19737v1, 2024.Vaswani et al., Attention Is All You Need, NeurIPS 2017.

BALAJI INSTITUTE OF TECHNOLOGY & SCIENCE

DIGITAL FORENSICS (OPEN ELECTIVE)

M.Tech CSE II Year I Sem.

L	T	P	C
3	0	0	3

Pre-Requisites: Cybercrime and Information Warfare, Computer Networks

Course Objectives:

1. To provide in-depth knowledge of the rapidly evolving field of digital forensics and its role in investigating cybercrimes.
2. To combine technical expertise with investigative skills to detect, analyze, and prevent digital crimes effectively.
3. To develop an understanding of forensic processes, including data acquisition, validation, and analysis, along with tools for e-discovery and evidence handling.
4. To equip students with knowledge on network forensics, mobile forensics, and legal aspects of digital forensics such as the IT Act and related amendments.

Course Outcomes: On completion of the course the student should be able to

1. Understand the fundamentals of digital forensics and the role of forensic science in solving cybercrimes.
2. Apply legal knowledge related to court orders, search, seizure, and documentation in cybercrime investigations.
3. Manage and present digital evidence while following proper forensic procedures and ensuring data integrity.
4. Use appropriate tools and techniques to investigate computer and network-based crimes effectively.
5. Analyze mobile forensic techniques and understand recent trends in mobile and electronic evidence handling.

UNIT - I

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.
Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber criminalistics area, holistic approach to cyber-forensics

UNIT - II

Cyber Crime Scene Analysis:
Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

UNIT - III

Evidence Management & Presentation:
Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

UNIT - IV

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, **Network Forensics:** open-source security tools for network forensic analysis, requirements for preservation of network data.

UNIT - V

Mobile Forensics: mobile forensics techniques, mobile forensics tools.
Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008.
Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

TEXT BOOKS:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

REFERENCES:

1. William Oettinger, Learn Computer Forensics: A beginner's guide to searching, analyzing, and securing digital evidence, Packt Publishing; 1st edition (30 April 2020), ISBN : 1838648178.
2. Thomas J. Holt, Adam M. Bossler, Kathryn C. Seigfried-Spellar , Cybercrime and Digital Forensics: An Introduction, Routledge.