# Jharkhand University of Technology Jharkhand, Ranchi

## Proposed Syllabus for B.Tech 4th Semester

## Computer Science & Engineering Information Technology

&

### Computer Science & Engineering

4th semester course structure

| Sl. No. | Course code | Subject | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 01 | CS401 | Operating System | 3 | 1 | 0 | 3 |
| 02 | CS402 | Design And Analysis Of Algorithms | 3 | 1 | 0 | 3 |
| 03 | CS403 | Formal Language And Automata Theory | 3 | 1 | 0 | 3 |
| 04 | BSC401 | Discrete Mathematics | 3 | 1 | 0 | 3 |
| 05 | IT401 | Database Management Systems | 3 | 1 | 0 | 3 |
| 06 | EN401/ IT402 | Engineering Economics / Cyber Security | 2 | 0 | 0 | 0 |
| | | | | | | |
| 01 | CS401P | Operating System Lab | 0 | 0 | 3 | 1 |
| 02 | CS402P | Design And Analysis Of Algorithms Lab | 0 | 0 | 3 | 1 |
| 03 | CS403P | Formal Language And Automata Theory Lab | 0 | 0 | 3 | 1 |
| 04 | EX401 | Extra Activities (NSO/NSS/NCC/Yoga/ Creative Arts/Mini Project) | 0 | 0 | 2 | 1 |
| 05 | IN401 | Internship/ Tour & Training/Industrial Training | 0 | 0 | 0 | 2 |
| **Total credit** | | | | | | **21** |

### Information Technology

4th semester course structure

| Sl. No. | Course code | Subject | L | T | P | Credit |
|---|---|---|---|---|---|---|
| 01 | IT401 | Database Management Systems | 3 | 1 | 0 | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 02 | CS401 | Operating System | 3 | 1 | 0 | 3 |
| 03 | CS402 | Design And Analysis Of Algorithms | 3 | 1 | 0 | 3 |
| 04 | CS403 | Formal Language And Automata Theory | 3 | 1 | 0 | 3 |
| 05 | BSC401 | Discrete Mathematics | 3 | 1 | 0 | 3 |
| 06 | EN401/ IT402 | Engineering Economics / Cyber Security | 2 | 0 | 0 | 0 |
| | | | | | | |
| 01 | CS401P | Operating System Lab | 0 | 0 | 3 | 1 |
| 02 | CS402P | Design And Analysis Of Algorithms Lab | 0 | 0 | 3 | 1 |
| 03 | CS403P | Formal Language And Automata Theory Lab | 0 | 0 | 3 | 1 |
| 04 | EX401 | Extra Activities (NSO/NSS/NCC/Yoga/ Creative Arts/Mini Project) | 0 | 0 | 2 | 1 |
| 05 | IN401 | Internship/ Tour & Training/Industrial Training | 0 | 0 | 0 | 2 |
| **Total credit** | | | | | | **21** |

# OPERATING SYSTEM

## Course Code- CS401

(3-CREDIT) (L-T-P/3-1-0)

**Module - I**

**OPERATING SYSTEMS OVERVIEW:** Introduction, Evolution of operating system, operating system operations, operating system structure, System Calls, Types of System Calls

**Modul – II**

**PROCESS MANAGEMENT:** Process concepts, process state, process control block, scheduling queues, process scheduling, Interposes Communication, Threads and implementation of threads.

**CPU SCHEDULING:** Objective and Criteria, CPU scheduling algorithms: FCFS, SJF, Priority Scheduling, Round robin, multilevel queue scheduling and multilevel feedback queue scheduling.

**Modul- III**

**CONCURRENCY AND SYNCHRONIZATION**: Process synchronization, critical section problem, and its solutions. Semaphores, classical problems of synchronization: readers and writers problem, dining philosophers problem, sleeping barber problem.

**Modul- IV**

**DEADLOCKS:** Introduction, deadlock characterization, Resource allocation graph, Methods for Handling Deadlocks: deadlock prevention, avoidance and deadlock detection, recovery from deadlock.

**Modul V**

**MEMORY MANAGEMENT:** Introduction, memory allocation techniques, paging, implementation of paging, segmentation and its implementation, segmentation with paging, virtual memory, demand paging, page-replacement algorithms, thrashing and its solution.

## Modul VI

**FILE SYSTEM:** Concept of a file, access methods, directory structure, file system mounting, file sharing, protection. File system implementation: file system structure, directory implementation, allocation methods, free-space management, efficiency and performance.

**Mass-Storage Structure:** Overview of mass storage structure, disk structure, disk scheduling algorithms,

**TEXT BOOKS:**

1. **ABRAHAM SILBERSCHATZ, PETER BAER GALVIN, GREG GAGNE (2012)**, Operating System Principles, 9th edition, Wiley India Private Limited, New Delhi.

**REFERENCE BOOKS:**

1. **William Stallings**, Operating Systems, Internals and Design Principles, 7th edition, Pearson Education, India. 2.

2. **Andrew S. Tanenbaum (2007)**, Modern Operating Systems, 2nd edition, Prentice Hall of India, India. 3. Deitel & Deitel (2008), Operating systems, 3rd edition, Pearson Education, India.

**COURSE OVERVIEW:**

Operating systems course is intended as a general introduced to the techniques used to implement operating systems and related kinds of systems software. The topics covered will be functions and structure of operating systems, process management (creation, synchronization, and communication); processor scheduling; deadlock prevention, avoidance, and recovery; main-memory management; virtual memory management (swapping, paging, segmentation and page-replacement algorithms); control of disks and other input/output devices; file-system structure and implementation; and protection and security

**COURSE OBJECTIVES:**

- ➢ To explain main components of OS and their working.
- ➢ To familiarize the operations performed by OS as a resource Manager.
- ➢ To impart various scheduling policies of OS.
- ➢ To teach the different memory management techniques.

**COURSE OUTCOMES:** At the end of the course students will be able to the following

- ➢ Outline various concepts and features of Operating systems.
- ➢ Compare various operating systems with respect to characteristics and features.
- ➢ Implement algorithm of CPU Scheduling, Memory Management and disk scheduling.
- ➢ Make changes in the OS configurations as per need.

# DESIGN AND ANALYSIS OF ALGORITHM

**Course Code- CS402**

(3-CREDIT) (L-T-P/3-1-0)

**Course Outcome:**

1. Ability to analyse the performance of algorithms.
2. Ability to choose appropriate algorithm design techniques for solving problems.
3. Ability to understand how the choice of data structures and the algorithm design methods impact the performance of programs.

**MODULE-I**

**INTRODUCTION & ANALYSIS:**

Analysing Algorithms, Recurrence Equations, Growth Function: Asymptotic Notation, Standard Notation & Common Functions, Recurrence Relation, Different Methods of Solution of Recurrence Equations with Examples.

**MODULE-II**

**DIVIDE AND CONQUER & BACKTRACKING PARADIGM:**

Introduction to Divide and Conquer Paradigm, Quick and Merge Sorting Techniques, Linear Time Selection Algorithm, The Basic Divide and Conquer Algorithm for Matrix Multiplication, Backtracking & Recursive Backtracking, Applications of Backtracking Paradigm, Heaps.

**MODULE-III**

**GREEDY PARADIGM & DYNAMIC PROGRAMMING:**

Greedy Paradigm: The Basic Greedy Strategy & Computing Minimum Spanning Trees, Algorithms of Kruskal and Prim, Union to Find Algorithm & Their Applications, Disjoint Set, The Relationship in Dijkstra's and Prim's Algorithms, Use of Greedy Strategy in Algorithms for the Knapsack Problem and Huffman Trees. The Basic Dynamic Programming Paradigm, Dynamic Programming Solution to the Optimal Matrix Chain Multiplication and the Longest Common Subsequence Problems.

**MODULE-IV**

**GRAPHS ALGORITHMS & STARING MATCHING ALGORITHMS:**

Representational Issues in Graphs, Depth First Search & Breath First Search on Graphs, Computation of Bi-connected Components and Strongly Connected Components Using DFS, Topological Sorting & Applications, Shortest Path Algorithms on Graphs: Bellman-Ford Algorithm, Dijkstra's Algorithm & Analysis of Dijkstra's Algorithm Using Heaps, Floyd-Warshall's all Pairs Shortest Path Algorithm and its Refinement for Computing the Transitive Closure of a Graph. The General String Problem as a Finite Automata, Kunth Morris and Pratt Algorithms.

**MODULE-V**

**NP-COMPLETE PROBLEMS:**

Solvable Problems, Types of Problems, The Notion of a Non-Deterministic Algorithm and its Basic Relationship to Backtracking, Polynomial Time Non-Deterministic Algorithms for Problems Like Satisfiability, Clique Problem, Hamiltonian Path Problems etc. The Definition of NP-Hardness and NP-Completeness, The Statement of Cook's Theorem and a Discussion of its Implication, The Notion of Polynomial Transformation, Vertex Cover, Subset Sum and Hamiltonian Cycle Problems are NP-Complete, Other Models for Computations.

**Text Books:**

1. Introduction to Algorithms (Second Edition); Cormen, Leserson, Rivert; PHI.
2. Fundamentals of Algorithms, Sahni& Horowitz; Galgotia.

**Reference Books:**

1. The Design & Analysis of Computer Algorithms, Hopcroft-Aho-Ullman, AWL.
2. Handbook of Algorithms & Data Structures, G.H. Gonnet, AWL.
3. Introduction to Design & Analysis of Algorithms, Levitin, PE-LPE.

---

---

# FORMAL LANGUAGES AND AUTOMATA THEORY

**Course Code- CS403** (3-

CREDIT) (L-T-P/3-1-0)

**Module I: Fundamentals & Finite Automata:**

Alphabet, Strings, Language, Operations, Mathematical proving techniques, Finite state machine, definitions, finite automaton model, acceptance of strings, and languages, Deterministic Finite Automaton (DFA) and Non deterministic Finite Automaton (NFA), transition diagrams and Language recognizers. Equivalence of DFA and NFA, NFA to DFA conversion, NFA with $\epsilon$ transitions - Significance, acceptance of languages. Equivalence between NFA with and without $\epsilon$ transitions, minimization of FSM, Finite Automata with output- Moore and Mealy machines and conversion of Mealy to Moore and vice-versa.

**Module II: Regular Expression and Languages:**

Regular sets, regular expressions, identity rules, Constructing finite Automata for a given regular expressions, Conversion of Finite Automata to Regular expressions. Regular grammars-right linear and left linear grammars, conversion of right linear grammar to left linear and vice-versa, equivalence between regular grammar, regular expression and FA, Pumping lemma of regular sets, closure properties of regular sets.

**Module III: Context Free Grammars and Push Down Automata:**

Context free grammar, derivation trees, sentential forms. Right most and leftmost derivation of strings. Ambiguity in context free grammars. Reduction of Context Free Grammars. Chomsky normal form (CNF), Greiback normal form (GNF), Pumping Lemma for Context Free Languages.

Simplification of CFL.

Push down automata (PDA) definition, model, acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. Equivalence of CFG and PDA, interconversion.

Introduction to DCFL and DPDA. DPDA Vs NPDA.

**Module IV: Turing Machine:**

Turing Machine definition, representation of Turing Machines model, Variants of TM, design of TM, linear bounded automata,

**Module V: Computational Complexity & Decidability, Recursively Enumerable Languages:**

**Complexity:** Growth rate of a function, class P and NP, polynomial time reduction and NP Completeness, NP-Complete problems (SAT, CSAT, Hamiltonian circuit, travelling salesman, vertex cover). **Decidability:** decidability, decidable language, undecidable language, halting problem of Turing Machine. **Computability:** primitive recursive function and recursive function.

**TEXT BOOKS:**

1. Theory of Computer Science (Automata Language and Computation) K.L.P. Mishra and N. Chandrasekran, PHI.
2. Introduction to Automata Theory, Language and Computation, John E, Hopcropt and Jeffery D. Ullman, Narosa Publishing House.

**REFERENCE BOOKS:**

1. Theory of Automata and Formal Language, R.B. Patel & P. Nath, Umesh Publication.
2. An Introduction and Finite Automata Theory, Adesh K. Pandey, TMH.
3. Theory of Computation AM Natrajan, Tamilarasi, Bilasubramani, New Age International Publishers, Chhattisgarh Swami Vivekan.
4. An introduction to Formal Languages and Automata by Peter Linz, Narosa Publ

---

# DATABASE MANAGEMENT SYSTEMS

## Course Code- IT401

## Module I

Introduction: Overview, Database System vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modelling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model, Relationship of Higher Degree.

## Module II

**Relational data Model and Language**: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction on SQL: Characteristics of SQL, Advantage of SQL. SQl Data Type and Literals. Types of SQL Commands. SQL Operators and Their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

## Module III

**Data Base Design & Normalization**: Functional dependencies, normal forms, first, second, 8 third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design

## Module IV

**Transaction Processing Concept:** Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System.

## Module V

**Concurrency Control Techniques:** Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction, Case Study of Oracle.

**References:**

1. Korth, Silbertz, Sudarshan," Database Concepts", McGraw Hill
2. Date C J, "An Introduction to Database Systems", Addision Wesley 3. Elmasri, Navathe, " Fundamentals of Database Systems", Addision Wesley
4. O'Neil, Databases, Elsevier Pub.
5. RAMAKRISHNAN"Database Management Systems",McGraw Hill
6. Leon & Leon,"Database Management Systems", Vikas Publishing House

7. Bipin C. Desai, " An Introduction to Database Systems", Gagotia Publications

8. Majumdar & Bhattacharya, "Database Management System", TMH

9. R.P. Mahapatra, Database Management System, Khanna Publishing House

---

# DISCRETE MATHEMATICS

**Course Code- BSC401**

(3-CREDIT) (L-T-P/3-1-0)

**MODULE-I**

**Mathematical Logic:**

Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

**MODULE-II**

**Set Theory:**

Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

**Algebraic Structures:**

Introduction, Algebraic Systems, Semi Groups and Monoids, Groups, Lattices as Partially Ordered Sets, Boolean Algebra.

**MODULE-III**

**Elementary Combinations:**

Basic of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multi-Nominal Theorems, The Principle of Inclusion-Exclusion.

**MODULE-IV**

**Recurrence Relations:**

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence Relations, Solving Recurrence Relations by Substitution and Generating Functions, The Method of Characteristic Roots, Solutions of Inhomogeneous Recurrence Relations.

**MODULE-V**

**Graphs and Trees:**

Basic Concepts, Isomorphisms and Subgraphs, Trees and Their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

**TEXT BOOKS:**

1. Discrete Mathematical Structures with Applications to Computer Science, J.P. Tremblay, R. Manohar, McGraw Hill Education (India) Private Limited (Units-I, II).
2. Discrete Mathematics for Computer Scientists & Mathematicians, Joe L. Mott, Abraham Kandel, Theodore P. Baker, Pearson, 2nd Edition (Units- III, IV, V).

**REFERENCE BOOKS:**

1. Discrete Mathematics and its Applications, Kenneth H. Rosen, 7th Edition, McGraw Hill Education (India) Private Limited.
2. Discrete Mathematics D.S. Malik & K. K. Sen, Revised Edition Cengage Learning.
3. Elements of Discrete Mathematics, C.L. Liu and D.P. Mohapatra, 4th Edition, McGraw Hill Education (India) Private Limited.
4. Discrete Mathematics with Applications, Thomas Koshy, Elsevier.
5. Discrete and Combinatorial Mathematics, R. P. Grimaldi, Pearson.
6. Discrete Mathematical Structures by Bernard Kolman, Robert C. Busby and Sharon Cutler Ross, Pearson Education.

---

# ENGINEERING ECONOMICS

**Course code –EN 401**

**COURSE OUTLINE:**

The basic purpose of this course is to provide a sound understanding of concepts and principles of engineering economy and to develop proficiency with methods for making rational decisions regarding problems likely to be encountered in professional practice.

**Module -1**

**Introduction of Engineering Economics and Demand Analysis**: Meaning and nature of Economics, Relation between science, engineering, technology and economics; Nature of Economic problem, Production possibility curve, Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility – its practical application and importance.

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, practical importance & applications of the concept of elasticity of demand.

**Module -II**

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

Various concepts of cost – Fixed cost, variable cost, average cost, marginal cost, money cost, real cost, opportunity cost. Shape of average cost, marginal cost, total cost, Cost curves.

**Module III**

Meaning of Market, Types of Market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets)

Pricing Policies- Entry Deterring policies, Predatory Pricing, Peak load Pricing. Product Life cycle

Firm as an organisation- Objective of the Firm, Type of the Firm, Vertical and Horizontal Integration, Diversification, Mergers and Takeovers.

**Module -IV**

Nature and characteristics of Indian economy (brief and elementary introduction), Privatization – meaning, merits and demerits. Globalisation of Indian economy – merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement, Business cycle, Inflation