Syllabus

Master of Computer Application (MCA)

First Semester

(2022-2024 Batch)

NATIONAL INSTITUTE OF SCIENCE & TECHNOLOGY
(AUTONOMOUS),
Institute Park, Pallur Hills, Berhampur,
Odisha, India – 761008

MCA Programme Structure (2022-2024 Batch)

First Semester					
Theory					
Sl. No	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**
1	IT	22MC101	Data Structure using C	3-0-0	3
2	IT	22MC102	Computer Organization and Architecture	3-0-0	3
3	IT	22MC103	Database Management Systems	3-0-0	3
4	MATH	22MC104	Mathematics – I: (Mathematical Foundation of Computer Science)	3-0-0	3
5	BM	22MC105	Communicative English	2-0-0	2
6	BM	22MC106	Environmental Science	3-0-0	0
Total Credit (Theory)					14
Practical					
1	LAB	22MC107	Data Structure Laboratory	0-0-3	2
2	LAB	22MC108	Database Management Systems Laboratory	0-0-3	2
3	LAB	22MC109	Communicative English Laboratory	0-0-3	2
4	SEM	22MC110	Seminar	0-0-2	1
Total Credit (Practical)					7
Total Semester Credit					21

Second Semester					
Theory					
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**
1	IT	22MC201	Object Oriented Programming using JAVA	3-0-0	3
2	IT	22MC202	Computer Networks	3-0-0	3
3	IT	22MC203	Operating Systems	3-0-0	3
4	IT	22MC204	Software Engineering	3-0-0	3
5	MATH	22MC205	Mathematics - II (Probability &Statistics)	3-0-0	3
Total Credit (Theory)					15
Practical					
1	LAB	22MC206	Object Oriented Programming using Java Laboratory	0-0-3	2
2	LAB	22MC207	Computer Networks Laboratory	0-0-3	2
3	LAB	22MC208	Operating Systems Laboratory	0-0-3	2
4	LAB	22MC209	Personality and Soft Skill Development	0-0-2	2
Total Credit (Practical)					8
Total Semester Credit					23

Third Semester					
Theory					
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**
1	IT	22MC301	Design and Analysis of Algorithms	3-0-0	3
2	IT	22MC302	Data and Web Mining	3-0-0	3
3	IT	22MC303	Python Programming	3-0-0	3
4	IT	22MC304	Artificial Intelligence	3-0-0	3
5	IT	22MC305 22MC306 22MC307 22MC308 22MC309	**Elective I** Computer Graphics and Multimedia/ Natural Language Processing/ IT Infrastructure Design/ Software Testing And Quality Assurance/ CBOT(Computer-based optimization techniques)	3-0-0	3
Total Credit (Theory)					15
Practical					
1	LAB	22MC310	Design and Analysis Algorithms Laboratory	0-0-3	2
2	LAB	22MC311	Python Programming Laboratory	0-0-3	2
3	PROJ	22MC312	Minor Project	0-0-3	4
4	SM	22MC313	Summer Internship	0-0-2	1
Total Credit (Practical)					9
Total Semester Credit					24

Fourth Semester					
Theory					
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**
1	IT	22MC401	Introduction to Machine Learning	3-0-0	3
2	IT	22MC402	Internet & Web Technology	3-0-0	3
3	IT	22MC403 22MC404 22MC405 22MC406 22MC407	**Elective II** Internet of Things (IoT)/ Computer Network Security/ Android App/ Soft Computing Techniques/ Cloud Computing	3-0-0	3
Total Credit (Theory)					9
Practical					
1	LAB	22MC408	Machine Learning Laboratory	0-0-3	2
2	LAB	22MC409	Internet & Web Technology Laboratory	0-0-3	2
3	PROJ	22MC410	Major Project / Industrial Training	0-0-4	12
Total Credit (Practical)					16
Total Semester Credit					25

FIRST SEMESTER DETAIL SYLLABUS

22MC101	Data Structure using C (3-0-0)	3 Credits

Course Objective:

1. To impart the basic concepts of data structures and algorithms
2. To understand concepts about searching and sorting techniques
3. To Understand basic concepts about stacks, queues, lists, trees and graphs
4. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures

Module- I: Introduction to Programming **(12 Hrs.)**

Introduction to Language: Structure of C Program, Keywords, Identifiers, Primitive Data types, variables, constants, input/output statements. Operators and Expressions: Expression evaluation: Operator Precedence and Associativity. Conditional Branching: One (simple if), two (if else) and multi way selection (else if ladder and switch and nested selection), Iteration and loops: Iterative statements, nested loops, break and continue statements. Arrays & Strings: One-dimensional, Two dimensional and Multi-dimensional arrays

Module- II: Function, Pointer & Structure **(12 Hrs.)**

Function: Declaration, Definition, Call by value, Call by reference, Scope of variables, Storage classes, Recursive functions. Defining pointers, Use of Pointers in Inter-function communication via arrays, matrices. Strings handling, Introduction to pointers. Dynamic memory allocation. Structures, Defining structures and Array of Structures, Structure vs Union, self-referential structures, notion of linked list (no implementation).

Module- III: **(10 Hrs.)**

Abstract Data Types – Definition and Representation, ADT of rational number, ADT of Stack, Data Structure and ADT. Stack and its usages: reversing string, matching parentheses, in fix to postfix. Queue: linear & circular queue. Linked list and its representation: using array, using self-referential structure. Singly, circular and double linked lists. Operations on linked list – Insertion, Deletion, Traversals. Usages of Linked list – insertion sort.

Module- IV: **(10 Hrs.)**

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Tree: Definition and Terminologies, child and parent nodes, Sub tree, root, leaf node, internal node, height of a Binary tree. Binary tree traversals. Sorting and Searching: Bubble sort, selection sort quick sort and merge sort. Linear and binary search, Fibonacci search.

Course Outcomes:

Upon the successful completion of the course, students will be able to:

1. Describe the basics of programming language and its syntax and understand the problem-solving aspect.
2. Design and develop C program to solve different real-life problems efficiently.
3. Analyse and compare different possible solutions.
4. Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data

Text Books:

1. Behrouz A. Forouzan & Richard F. Gilberg, "A structured Programming Approach Using C", 3rd Edition, Cengage Publication, ISBN: 9788131503638, 2007.
2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, 2nd Edition, Prentice Hall of India, 2015.
3. Byron Gottfried, Schaum's Outline of Programming with C, 3rd Edition, McGrawHillBook, 1st July 2017.
4. Data Structures: A Pseudocode Approach with C – Gilberg & Forouzan, 2nd Edition, Cengage, Indian Reprint 2016
5. Data Structures and Program Design in C – Kruse, Leung, 2nd Edition, Pearson,2008

Course Name	Programming and Data Structures
Course Link	https://nptel.ac.in/courses/106105085/4
Course Instructor	Dr. P. P. Chakrabarti Department of Computer Science and Engineering Indian Institute of Technology Kharagpur

22MC102	Computer Organization and Architecture (3-0-0)	3 Credits

Course Objectives:

1. Able to understand the basic organizational structure of computer system along with the operational concepts, the concepts of ALU, CU and Memory design, the concept of cache memory, virtual memory and principle of pipelining.
2. Able to solve the problems related to cache memory and performance, page replacement algorithms, memory construction, arithmetic operations, and pipelining.
3. Able to to explain and apply the basic concepts of memory, its construction and analysis of performance related memory hierarchy.
4. Able to analyze the performance differences of computing evolution on basic operation like addition, multiplication and division, page replacement algorithms and cache memory mappings.

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Module-I: (10 hrs)

Functional blocks of a computer: CPU, memory, input-output subsystems, Von-Neuman vs Harvard Architecture, Instruction set architecture of a CPU–registers, instruction execution cycle, Basic Operational Concepts, addressing modes, instruction set. Case study – instruction sets of some common CPUs.

Module-II (12 hrs)

Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, signed number representation, fixed and floating-point representations, floating point arithmetic.

CPU control unit design: hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Module-III (8 hrs)

Memory system design: semiconductor memory technologies, memory organization.

Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

Module-IV **(6 hrs)**

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes–role of interrupts in process state transitions, I/O device interfaces – SCII, USB

Module-V **(6 hrs)**

Pipelining: Basic concepts of pipelining, throughput, speedup and efficiency, pipeline hazards: Structural hazards, data hazards, control hazards.

Course Outcomes:

1. Understand the basic organization of computer and instruction execution cycles along with their instruction formats and different addressing modes.
2. Gain knowledge on the architectural and circuit level design of arithmetic logic unit & control unit and can solve different arithmetic problems.
3. Explain and apply the basic concepts of memory, its construction and analysis of performance related memory hierarchy.
4. Gain knowledge on the different I/O interfaces, modes of data transfer and basic principles of pipelining.

TEXT BOOKS:

1. "Computer Organization" 5th edition Carl Hamacher, Zvonkovranesic, Safwat Zaky, McGraw Hill.

2. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

REFERENCE BOOKS:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill.

2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.

3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Name	Computer Organization and Architecture

Course Link	https://nptel.ac.in/courses/106/106/106106166/
Course Instructor	V. Kamakoti Indian Institute of Technology Madras, Chennai, India.

22MC103	Database Management Systems **(3-0-0)**	**3 Credits**

Course Objective:

1. Introducing basic database concepts like E-R Diagram, Relational Algebra,
2. Designing Normalized databases
3. Advantages, disadvantages and implementation of NoSQL database design in contrast to SQL based database.
4. Introducing database transactions

Module-1: (7 Hours)

Introductory concepts of DBMS: Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture- levels, Mappings. Entity-Relationship model: Basic concepts, Design process, constraints, Keys, Design issues, E-R diagrams, weak entity sets. Reduction to E-R database schema.

Module-2: (7 Hours)

Database Programming: Relational Algebra and calculus (Domain and Tuple relational calculus) Basics of SQL, DDL,DML,creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. Transaction control commands – Commit, Rollback, save point. Concepts, Cursors, Stored Procedures, Stored Function, and Database Triggers.

Module-3: (13 Hours)

Normalization of Databases: Functional Dependency – definition, trivial and non-trivial FD, closure of FD set, closure of attributes, irreducible set of FD, Normalization – 1NF, 2NF, 3NF, Decomposition using FD- dependency preservation, BCNF, Multi- valued dependency, 4NF, Join dependency and 5NF.

Module-4: (7 Hours)

Transaction Management: Transaction concepts, properties of transactions, serializability of transactions, testing for serializability, System recovery, Two- Phase Commit protocol, Recovery and Atomicity, Log-based recovery, concurrent executions of transactions and related problems, Locking mechanism, solution to concurrency related problems, deadlock, , two-phase locking protocol.User security, grants, privileges, roles, access control.

Module-5: (10 Hours)

Performance tuning and introduction to NOSQL. Overview of NOSQL databases, measures of query cost, selection operation, sorting, join, Performance Tuning Overview, Basic Tuning Tools, Using Statspack, Identifying Problem SQL Statements, Query Optimization Influencing the Optimizer (Indexes (B-tree, Bitmap, Function Based indexes and reverse key indexes).

Course Outcome:

1. Designing database and manipulating data for different real life problems
2. Apply SQL queries for retriving columns using functions and related database.
3. Displaying data from multiple table using join and sub-queries
4. Designing and differentiating solutions using schema based database.

Suggested Books:

1. Elmasari &Navathe, Fundamentals of Database System, Seventh Edition, Pearson Education Book .
2. Sudarshan, Korth, Database System Concepts, 6th edition, McGraw-Hill Education Book .
3. Prof. Partha Pratim Das, Department of Computer Science & Engineering, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc18_cs15/preview
4. Prof. Arnab Bhattacharya, IIT Kanpur https://nptel.ac.in/courses/106104135/
5. Dr. Leo Mark, Georgia Institute of Technology, https://in.udacity.com/course/database-systems-concepts-design--ud150

22MC104	Mathematics-I(Mathematical foundation for Computer Science)(3-0-0)	3 credit

COURSE OBJECTIVES:

- Apply the knowledge of matrix to compute Eigen values, Eigen vectors, solve system of linear equations, inverse of matrices.
- To develop logical thinking and its applications to computer science.
- Mathematical (computing, reasoning, analytic, and geometric) approach to data analysis.
- To understand the concept of graphs, theory and their application in solving practical network based problems.

SYLLABUS

Module-I: Systems of Linear Equations, Eigen Values and Eigen Vectors [8 Hrs]

Basic concept of matrix and its operation, System of linear equations (Gauss-Elimination and Gauss-Jordan method), Rank of a matrix, Existence and uniqueness of solution of linear systems, Inverse of matrices (Gauss-Jordan Method), Eigen values and Eigen vectors of a matrix with their properties.

Module-II: Logic and Counting Principle [9 Hrs]

Logic: Propositions, Propositional equivalences, Predicate and quantifiers, Rules of inference, Introduction to proofs, Mathematical induction.

Counting: The basics of counting, the Pigeonhole principle, Permutations and combinations, Recurrence

relations, Solving linear recurrence relations, Generating functions, Inclusion-Exclusion and applications of Inclusion-Exclusion.

Module-III: Relations, Elementary Algebraic Structure [08 Hrs]

Relations: Relations and their properties, n-ary relations and their applications, Representing relations, Closures of relations, Equivalence relations, Partial orderings.

Definition and elementary properties of groups, subgroups, ring, fields, and vector spaces.

Module-IV: Lattice and Boolean Algebra [07 Hrs]

Boolean Algebras: Lattices and algebraic systems, Principle of duality, Basic properties and algebraic systems defined by lattices, Distributive and complemented lattices, Boolean lattices and Boolean algebras.

Module-V: **Graph Theory [08 Hrs]**

Introduction to graphs, Graph Terminology, Representing Graphs and Graph Isomorphism, Euler and Hamilton Paths, Shortest Path Problem, Dijkstra's Algorithm, Planar Graphs (Euler's formula and its applications only), Graph colouring.

Trees: Introduction to Trees, Spanning Tree, Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm,

OUTCOMES

1. Application of matrix theory and linear algebra to solve system of equations .
2. Applying set theory and logic to solve the real valued problems easily.
3. Solving different problems suing Lattice..
4. Solving different practical network based problems through graphical methods..

TEXT BOOKS

1. K. H. Rosen, *Discrete Mathematics and Its Applications*, 6th Edition, Tata McGraw Hill Publication. [Chapters - 1(1.1 – 1.3, 1.5 – 1.6), 4(4.1), 5(5.1 – 5.3), 6(6.1 – 6.2, 6.4 – 6.6), 7(7.1 – 7.6), 8(8.1 – 8.3, 8.5 – 8.8), 9(9.1, 9.4, 9.5)]
2. C. L. Liu and D. P. Mohapatra, *Elements of Discrete Mathematics–A Computer Oriented Approach*, 4th Edition, Tata McGraw Hill, 2013. [Chapter – 10(10.1 – 10.3, 10.10), 11(11.1 – 11.5)]
3. E. Kreyszig, Advanced Engineering Mathematics, 10th Edition, Willey. [Chapter – 7(7.1 – 7.5, 7.8)]

REFERENCE BOOKS

1. B. Kolman, R.C. Busby, and S.C.Ross, *Discrete Mathematical Structures*, Pearson Education.
2. J. P. Trembly, and R. Manohar, *Discrete Mathematical structures with Applications to Computer Science*, Tata McGraw Hill.

N.B: The course is of 3 credits with 4 contact hours

22MC105	Communicative English (3-0-0)	3 Credits

Course Objective:

1. To communicate effectively by developing competent textual, visual and non-verbal communicationabilities.
2. To draft effective formal written business messages in various formats andstyles.
3. To learn the skills to effectively deliver formal oral presentations to a variety of

audiences in multiplecontexts.

4. To be acquainted with the soft skills and various selection procedures adopted by therecruiters.

Module-I: [8Hrs]

Basics of Communication Skills

Significance of communication, The process and factors of communication (the communication loop), Difference between General and Technical Communication, Verbal communication and its principles, Non- verbal communication, The importance of audience & purpose.

Module-II:[10Hrs]

Basics of English Pronunciation & Soft Skills

Introduction to English pronunciation with the IPA chart, Received Pronunciation, problems of Indian English, Professional presentations, Group Discussion, Interview etiquette, Leadership skills

Module-III:[6Hrs]

Grammar & Vocabulary

Parts of speech &Tense, Voice Change, Direct and Indirect Speech, Concord, Parallelism, Word formation- root words, synonyms, antonyms, homonyms & homophones, Common errors in English Grammar

(N.B. – This unit should be taught by assigning activities to the students in theclass)

Module-IV [6Hrs]

Basics of Reading and Writing Skills

Reading Skill: Types of reading, Sub-skills of reading: Skimming, Scanning, reading comprehension, Writing Skill: Steps to writing, Describing, Defining, Classifying and Providing examples or evidence, Empathetic and Result-Oriented Writing.

Module-V: [10Hrs]

Professional Writing:

Paragraph, Letter, Memos & Circulars, Reports, Proposals, e-mails & CV, Cover Letters, Job Application

Course Outcome:

At the end of the course, the student will be able to:

1. Become adept in their use of the spoken word in interpersonal communication, small group interaction and public speaking.
2. Use an appropriate style and format to write letters (formal and informal), prepare result-oriented reports, prepare CVs and draft businessdocuments.
3. Gather and prepare information and apply it to persuade or articulate one's own point of view clearly and efficiently.
4. Comprehend the employability market, identify the organizations to get good placements and broaden career plans by developing all-roundpersonality.

Reference Books:

1. Communication Skills by Sanjay Kumar and PushpaLata, Oxford UniversityPress
2. Technical Communication, Principle and Practice by Meenakshi Raman &Sangeeta Sharma, Oxford UniversityPress
3. Effective Technical Communication, M Ashraf Rizvi, Tata McGraw –Hill.
4. Business Communication, Meenakshi Raman &PrakashSingh,Oxford
5. Communication for Management, UrmilaRai and S M Rai,HPH
6. Business and Managerial Communication, Sengupta,PHI
7. Business Communication for Managers, P. Mehra,Pearson
8. Soft Skills K Alex, SChand

Suggested Readings:

1. Manual of English Grammar and Composition. J.C. Nesfield ForgottenBooks
2. Practical English Usage. Michael Swan.OUP.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford UniversityPress
4. A Course in English phonetics by T.R. KANSAKAR, ORIENT LONGMENPress.
5. A Communicative Grammar of English, Leech, Geoffrey & Jan Svartvik,,Longman

22MC106	Environmental Science (2-0-0)	0 Credits

Course Objective:

1. To give students an understanding of how science and the scientific method work to address environmental problems.

2. Students will learn about the interaction of human society (urban sprawl, energy use/generation, resource consumption and economics) with the Earth's systems
3. students will learn about air pollution and global climate change.students will apply their knowledge for efficient environmental decision-making, management and sustainable development.
4. Students will prepare for successful career in environmental departments, research institutes, industries etc.

Module – I

Ecological Concepts and Natural Resources: Ecological perspective and value of environment. Ecosystem: Concept, structure & Function of ecosystem; Energy cycle, Food Chain, & Food Web; Ecological pyramid, types; Biodiversity; Ecological Succession: Type of ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem. Geochemical Cycle: Water cycle, Carbon cycle, Oxygen cycle, Nitrogen cycle, etc., Sedimentation Cycle: Sulphur cycle, phosphorous cycle; Environmental gradients, Tolerance levels of environment factor, Indian Environmental Law; Environmental Auditing.

Module – II

Water quality standards and parameters, Assessment of water quality, Organic content parameters, Types, sources and consequences of water pollution; Ground water Contamination, Waste Water Treatment: DO and BOD of Waste water; Waste water treatment process: pre-treatment, primary treatment, (Sedimentation, equalization and neutralization etc.), secondary treatment (Activated sludge technique and Trickling filter) tertiary treatment methods (Evaporation, Ion exchange, Adsorption, Electrodialysis, Electrolytic recovery, reverse osmosis).

Module – III

Air Pollution : Air pollution and pollutants, criteria pollutants & non-criteria pollutants, Acid deposition, Global climate change –greenhouse gases, Ozone layer Depletion, Smog; Industrial Air Emission Control: Flue gas desulphurization, NOx removal, Fugitive emissions. Methods for control of particulate air pollutants (Mechanical device, Fabric Filtration, scrubber, Electrostatic precipitator)

Module – IV

Solid Waste Management Source classification and composition of MSW: properties and separation, storage and transportation, MSW Management, Waste minimization of MSW, Reuse and recycling,

Hazardous Waste Management, Hazardous waste and their generation, Transportation and treatment of hazardous waste: Incinerators, Inorganic waste treatment, handling of treatment plant residue. Waste minimization techniques.

Noise Pollution: Physical Properties of sound, Noise criteria, Noise Standards, Noise measurement, Noise control.

Text Book

1. Environmental Engineering Irwin/ McGraw Hill International Edition, 1997, G. Kiely,
2. Environmental Engineering & Safety by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack

Reference Books

1. Environmental Engineering by Arcadio P. Sincero & Gergoria A.Sincero PHI Publication
2. Principles of Environmental Engineering and Science, M. L. Davis and S. J. Masen, McGraw Hill International Edition, 2004
3. Environmental Science, Curringham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.

22MC107	Data Structure Laboratory (0-0-4)	2 Credits

Course Objective:

This course is aimed at concepts of programming and software code development of moderate complexity using C programming language within the framework of structural and procedural programming paradigms and data structure.

List of Suggested Programs

1. Familiarity with basic LINUX command, vi editor.
2. Programs on arithmetic expressions, data type limits, operators and precedence.
3. Programs on Conditional Branching and Loops.
4. Programs on 1D and 2D array handling.
5. Programs on String handling and Functions
6. Programs on Pointers and Structure.
7. Implementation of Stack and Queue
8. Infix to Postfix conversion, Insertion sort
9. Linear and Binary Search
10. Bubble sort, Merge sort and Quick sort.

Course Outcomes:

Upon the successful completion of the sessional course, students will be able to:

1. Understand problem solving approach of moderate complexity in Linux environment.
2. Design and develop C program to solve different real life problems efficiently.
3. Analyse and compare different possible solutions.

22MC108	Database Management Systems **Laboratory (0-0-4)**	2 Credits

1. Retrieving Data Using the SQL SELECT Statement.
2. Restricting and Sorting Data.
3. Manipulating Data.
4. Using DDL Statements to Create and Manage Tables.
5. Using Single-Row Functions to Customize Output.
6. Reporting Aggregated Data Using the Group Functions.
7. Displaying Data from Multiple Tables.
8. Using Sub queries to Solve Queries.
9. Creating Other Schema Objects (indexes, views).
10. User security (privileges, roles).
11. Cursors and composite data types...
12. Functions and procedures.
13. Packages.
14. Triggers.
15. Mini project (Application Development)

Suggested Books: Murach's My SQL: Joel Murach , 2nd Edition.

22MC109	**Communicative English Laboratory (0-0-4)**	2 Credits

(This unit involves interactive practice sessions in Language Lab)

1. Listening Comprehension
2. Pronunciation, Intonation
3. Stress and Rhythm practice
4. Common Everyday Situations: Conversations and Dialogues
5. Formal Presentations
6. Reading Comprehension
7. Report writing
8. Writing letters, e-mails,
9. Writing essay, CV, etc…
10. Grammar activities

22MC110	Seminar (0-0-1)	1 Credits

SECOND SEMESTER DETAIL SYLLABUS

22MC201	Object Oriented Programming using JAVA (3-0-0)	3 Credits

Course Objective:

Learn the syntax, semantics and idioms of the Java programming language. Gain confidence in object-oriented programming principles through lots of practical exercises that provide useful exposure to the core Java class libraries.

1. Understand the basic object-oriented programming concepts and apply them in problem solving.
2. Illustrate inheritance concepts for reusing the program.
3. Students will able to learn about. Multi-Threading, String Handling and Java I/O.
4. Students will Develop and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing.

Module- I **(8 Hours)**

Introduction to Java and Java programming environment. Object Oriented Programming Concepts: Encapsulation, Abstraction, Inheritance, Polymorphism. **Fundamental Programming Structure**: Data Types, variable, keywords, typecasting, Arrays, Operators and their precedence. **Control Flow**: Java's Control Statements (if, switch, iteration, statement, while, do-while, for, Nested loop). Concept of Objects and Classes, Using Existing Classes building your own classes, constructor overloading, static, final, this keyword.

Module - II **(8 Hours)**

Inheritance: Introduction, types of inheritance. Use of super keyword. Method overriding, Dynamic method Dispatch, Using Abstract Classes, Using final with inheritance. The Object Class.

Packages & Interfaces: Packages, Access Protection, importing package, Interface, Implementing Interfaces, variables in Interfaces, Interfaces can be extended.

Exception Handling: Fundamentals, Types Checked, Unchecked exceptions, Using try & catch, Multiple catch, throw , throws, finally, Java's Built in exceptions, user defined exception.

Module –III **(8 Hours)**

Multi-Threading: Java Thread Life Cycle, Thread Priorities, Synchronization, Creating a thread, Runnable interface, Creating Multiple threads, Using isAlive () and join (), wait () & notify().

String Handling: String constructors, String length, Character Extraction, String Comparison, Modifying a string.

Java I/O: Classes & Interfaces, Stream classes, Byte streams, Character streams, Serialization.

Module IV **(6 Hours)**

Wrapper Classes: Wrapper classes and its methods.

Collection Framework: Introduction, interfaces, List, Set, Map etc, List interfaces and its classes.

Introduction to Database: Introduction to Database. Driver Types, Registering Driver, Creating Connection, Executing SQL query using Statement, PreparedStatment. ResultSet methods.

Module V **(10 Hours)**

Event Handing: Event Delegation Model, Event Classes, Event Listener Interfaces, Adapter classes.

AWT: AWT Classes window fundamentals, component, container, panel, Window, Frame, working with Graphics, Control Fundamentals, Layout managers, Handling Events by Extending AWT components.

Swing: Icons & Labels, Text fields, Buttons, Combo boxes, Tabbed panes, Scroll panes, Trees, Tables.

Course Outcome:

After completing this course, students will be able to:

1. Understand and implement various Object Oriented Concepts like inheritance, abstraction and polymorphism.
2. Work with Collection Classes and Files, Multiple Threads, & handle Exceptions.
3. Develop applications to interact with a Database.
4. Design and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing.

Suggested Books and Materials :

1. Java: One Step Ahead by Anita Seth (Author), B.L. Juneja (Author) Oxford University Press.

2. Head First Java 2nd edition Kathy Sierra & Bert Bates 3. JAVA Complete Reference (9th Edition) Herbert Schildt.
4. https://www.udemy.com/java-the-complete-java-developer-course/
5. Java Programming Masterclass for Software Developers Created by Tim Buchalka, Tim Buchalka's Learn Programming Academy, Goran Lochert

Suggested Books and Reading Materials:

1. Java: One Step Ahead by Anita Seth (Author), B.L. Juneja (Author) Oxford University Press.
2. Head First Java 2nd edition Kathy Sierra & Bert Bates 3. JAVA Complete Reference (9th Edition) Herbert Schildt.
4. https://www.udemy.com/java-the-complete-java-developer-course/
5. Java Programming Masterclass for Software Developers Created by Tim Buchalka, Tim Buchalka's Learn Programming Academy, Goran Lochert

Course Name	Programming in JAVA
Course Link	https://onlinecourses.nptel.ac.in/noc21_cs03/preview
Course Instructor	Prof. Debasis Samanta Dept. Computer Science and Engineering from Indian Institute of Technology, Kharagpur

22MC202	Computer Networks (3-0-0)	3 Credits

Course Objective:

1. Understand the concepts of data communication, layered model, wireless devices in computer networks.
2. Students will be able to understand the various techniques used to access a shared channel in the network and IEEE specifications for LANs.
3. Students will learn about different types of networking devices, backbone networks and Internet Protocol (IP)addressing.
4. Understand the responsibilities of network, transport and application layers.

Module – I **(12 Hrs)**

Overview of Data Communication Networks, Protocols and standards, OSI Reference model, TCP/IP Protocol.

Physical Layer: Analog Signals, Digital Signals, Data Rate Limits, Transmission Impairment, Data rate limit, Multiplexing: Frequency Division Multiplexing (FDM), Wave Division Multiplexing (WDM), Time Division Multiplexing

(TDM), Transmission Media: Guided Media (Twisted-Pair Cable, Coaxial Cable and FiberOptic Cable) and unguided media (wireless), Switching: Circuit Switched Network, Datagram Network, Virtual-Circuit Network , Telephone Network, Dial-up Modems and Digital Subscriber Lines.

Module – II **(12 Hrs)**

Error Detection and correction: Types of Errors, Error Detection mechanism (Linear codes, CRC, Checksum), Error Correction mechanism: Hamming Encoding. Data Link Control and Protocols: Flow and Error Control, Stop-and-Wait ARQ. Go-Back-N ARQ, Selective Repeat ARQ, HDLC and Point-to-Point Protocol Multiple Access: Random Access (ALOHA, CSMA, CSMA/CD, CSMA/CA), Controlled Access (Polling, Reservation,

Token Passing), Channelization (FDMA, TDMA, CDMA). Wired LANs (Ethernet): Traditional Ethernet, Fast Ethernet, Gigabit Ethernet.

Module – III **(06 Hrs)**

Wireless LANs: IEEE 802.11 and Bluetooth.

Connecting Devices: Passive Hub, Repeater, Active Hub, Bridge, Two layers Switch, Router, Three layers Switch, Gateway.

Virtual Circuit Networks: Frame Relay, Architecture & layers, ATM: Design goals, Architecture & layers.

Module – IV **(06 Hrs)**

Network Layer: IPV4 addresses, IPV6 addresses, Internet Protocol: Internetworking, IPV4 datagram, IPV6 packet format and advantages. Network Layer Protocols: ARP, RARP, IGMP and ICMP. Routing: Unicast Routing Protocols and Multicast Routing Protocols.

Transport Layer: Process to Process Delivery, User Datagram Protocol (UDP) and Transmission Control Protocol (TCP).

Module – V **(04 Hrs)**

Domain Name System (DNS): Name Space, Domain Name Space, DNS in Internet, Resolution and Dynamic Domain Name System (DDNS), Remote logging, Electronic Mail

(SMTP) and file transfer (FTP), WWW: Architecture & Web document, HTTP: Transaction & Persistent vs. Non-persistent connection. Introduction to Wi-Fi and Li-Fi Technology.

Course Outcome:

1. Understand the layered communication architectures (OSI and TCP/IP) and different transmission techniques for communication over a network.
2. Recognise devices used in 3 lower layers. Understand and apply flow and error control during data tranmission with the associated protocols and mechnism of channel access methods.
3. Understand and apply host addressing logic & subneting concepts with associated protocols of network layer and transport layer.
4. Understand protocols involved in application layer to facilitate high level applications.

Suggested Books and Online Resources:

1. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill, 5thEdition(2013).
2. Computer Networks, A. S. Tannenbum, D. Wetherall, Pearson Education, 5thEdition(2014).
3. Data and Computer Communications, William Stallings, Pearson Education, 10thEdition(2018).
4. Computer Networking, A Top-Down Approach, James F. Kurose, Keith W. Ross, Pearson publication, 6thEdition(2017).
5. http://www.nptelvideos.in/2012/11/computer-networks.html, Prof. SujoyGhosh, IIT, Kharagpur.

Course Name	COMPUTER NETWORKS AND INTERNET PROTOCOL
Course Link	https://nptel.ac.in/courses/106105183/
Course	Prof. Soumya Kanti Ghosh,

Instructor	IIT, Kharagpur.

Course Name	Introduction to Computer Networking
Course Link	https://www.classcentral.com/course/stanford-openedx-introduction-tocomputer-networking-1578
Course Instructor	Prof. Philip Levis and Professor Nick McKeown, Stanford University

22MC203	Operating Systems (3-0-0)	3 Credits

Course Objectives:

1. successful student will be able to understand the basic components of a computer operating sys-tem, and the interactions among the various components.
2. The course will cover an introduction on the policies for scheduling, deadlocks, memory management, synchronization, system calls, and file systems.
3. Students will be able to Understand the concepts of virtual memory management, file system.
4. Students will be able to Understand the concepts of secondary storage structure, protection and case study of Linux operating system.

Module- I: **(8 Hrs.)**

Overview: Operating System, Simple Batch Processing Systems, Multiprogramming and Time-sharing systems Operating System Structures, Operating System Services and system calls.

Process: Process Concept, Process Scheduling, Operation on Processes, Inter-process communication, Examples of IPC Systems, Multithreading Models, Threading Issues.

Module- II: **(10 Hrs.)**

Process Scheduling: scheduling criteria, scheduling algorithms

Process Synchronization: Critical section problem, two-process and multi-process solutions, Semaphores, Classical problems of synchronization, Monitors.

Deadlocks: System model, Deadlock Characterization, Handling Deadlocks, Deadlock Prevention, Deadlock avoidance, Deadlock Detection and recovery from Deadlock.

Module- III: **(10 Hrs.)**

Memory Management: Memory Management strategies, Logical versus Physical Address space, swapping, contiguous Allocation, Paging, Segmentation.

Virtual Memory: Background, Demand paging, performance of Demand paging, Page Replacement, Page Replacement Algorithms, Allocation of frames, Thrashing and its prevention, Paging with segmentation

Module- IV: **(6 Hrs.)**

File system: file structure, file operations, file access methods, Directory Structure, Directory Implementation, and Allocation Methods

Mass Storage: Overview of Mass Storage Structure, Disk Structure, Disk Scheduling,

Disk Management, Swap-Space Management

Module- V: **(6 Hrs.)**

I/O System: I/O System Overview, I/O Hardware, Application I/O Interface, Kernel I/O Subsystem, Transforming I/O Request to Hardware Operation

Case studies on Linux: Basic Concepts; System Administration-Requirements for Linux System Administrator, setting up a LINUX Multifunction Server, Domain Name System, Setting up Local Network Services.

Course Outcome:

1. Understand the different services provided by Operating System at different level and the design structure and learn real life applications of the same.
2. Solve and implement different process scheduling algorithms, synchronization techniques and methods of handling deadlock.
3. Describe different memory management techniques and solve problems related to paging, segmentation, fragmentation and page replacement.
4. Use concepts of file management, disk management and solve problems regarding file allocation methods and disk scheduling.

Suggested Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Concepts, 8th edition, Wiley-India, 2009
2. William Stallings, Operating Systems: Internals and Design principles, 6th Edition, PHI Learning Pvt. Ltd, 2010
3. H.M. Deitel, P. J. Deitel, D. R. Choffnes, Operating Systems, 3rdEdition, Pearson
   Education, Dec 2003
4. Andrew S. Tanenbaum: Mordern Operating Systems, 4th Edition, Pearson Education, 2014
5. Naresh Chouhan: Principles of Operating System, Oxford University Press.

Web Courses/Online courses:

Course Name	INTRODUCTION TO OPERATING SYSTEMS
Course Link	https://nptel.ac.in/courses/106106144/2
Course Instructor	Prof. Chester Rebeiro, IIT Madras

22MC204	Software Engineering (3-0-0)	3 Credits

Course Objective:

1. Explain different software development paradigm
2. Demonstration of UML diagrams and its pros and cons
3. Explain different metrics used in project management
4. Explain different software engineering practices.

Module-I: **(8 Hrs.)**

Introduction, Introduction to Software Development processes, Agile software development: Agile methods, Plan-driven and agile development, Extreme programming, Agile Process model: Adoptive software development, scrum, crystal, Agile modelling, Agile unified process.

Module-II: **(6 Hrs.)**

Requirements engineering: Functional and non-functional requirements: The software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management

Module-III: **(10 Hrs.)**

Object-oriented design using UML: Analysis and Design: Concepts, Classes and Objects. Relationships Among Objects. Inheritance and Polymorphism, Design Concepts, Design Notation and Specification, Design Methodology, Dynamic Modelling, Functional Modelling, Defining Internal Classes and Operations, Design patterns. System modelling: Context models, Interaction models, Structural models, Behavioural models Model-driven engineering

Module-IV: **(6 Hrs.)**

Architectural design: Architectural design decisions, Architectural views, Architectural patterns, Application architectures, Design and implementation, Testing: Introduction to software testing, verification and validation, unit testing, integration testing, system testing. Software Maintenance.

Module-V: **(10 Hrs.)**

Project management: introduction to Risk management, managing people, Teamwork, Project planning, Software pricing, Plan-driven development, Project scheduling,

Estimation techniques, Quality management, Software measurement and metrics Introduction to Advanced Software Engineering concepts: Software reuse, Component based software engineering, Distributed software

engineering, Service-oriented architecture, Embedded software, Aspect-oriented software engineering

Course Outcome:

1. To understand basic concepts of software engineering and outline the features of different lifecycle models.
2. To explain the principles involved in gathering and validating software requirements.
3. To make use of suitable models through analysis of requirements and arrive at an appropriate software design.
4. To appreciate the quality assurance procedures during software development and able to handle the post implementation issues of software project and software maintenance practices.

Text Book:

1. Rajib Mall, Fundamentals of Software Engineering, Fifth Edition, PHI, 2018

Reference Books:

1. Software Engineering, A Practitioner's Approach, Roger S. Pressman, TMG Hill.
2. Fundamentals of Software Engineering, Rajib Mall, PHI, 2014.
3. Software Engineering, I. Sommerville, 9th Ed., Pearson Education.

Digital Learning Resources

Course Name	SOFTWARE ENGINEERING
Course Link	https://nptel.ac.in/courses/106105182/
Course Instructor	PROF. RAJIB MALL Dept. of Computer Science and Engineering, IIT Kharagpur

Course Name	SOFTWARE ENGINEERING
Course Link	https://nptel.ac.in/courses/106/101/106101061/
Course Instructor	Prof.Rushikesh K Joshi, Prof.UmeshBellur,Prof. N.L. Sarda, IIT Bombay,

22MC205	**Mathematics-II (Probability and Statistics) (3-0-0)**	**3 Credit**

Course Objective

The course should enable the students to:

- Enrich the knowledge of probability on single random variables and probability distributions.
- Understand the foundations for classical inference involving confidence intervals and hypothesis testing.
- Analyse the given data for appropriate test of hypothesis.
- Apply the concept of correlation and regression.

SYLLABUS

Module-1: Fundamentals of Probability **[6 hrs]**

Sample Space, Events, Counting sample points, Probability of an event, Additive Rules, Conditional Probability, Multiplicative rules, Baye's Rule.

Module-2: Random Variables and Probability Distributions **[10 hrs]**

Discrete and continuous random variables, Discrete and continuous probability distributions, Joint probability distribution, Mathematical expectation: mean, variance and standard deviation of a probability distribution. Binomial distribution, Poisson distribution and Poisson process, Normal distribution, Areas under the normal curve, Applications of the normal distribution, Normal approximation to the binomial.

Module-3: Fundamental Sampling and Estimations **[10hrs]**

Random Sampling, Some important statistics, Sampling distribution: Sampling distribution of mean and variance, t-distribution, Statistical inference, Classical methods of estimation, Single sample: estimating the mean, Standard error of point estimate, Prediction intervals, estimation of variance.

Module-4: Testing of Hypothesis **[8 hrs]**

Statistical hypothesis, Testing a statistical hypothesis, One and two tailed tests, Decision making in testing hypothesis, Test concerning a single mean, Goodness of fit test.

Module-5: Correlation and Regression **[6 hrs]**

Bivariate distribution, Correlation, Scatter Diagram, Karl Pearson coefficient of correlation, Calculation of the Correlation Coefficient for a Bivariate Frequency Distribution, Probable Error of Correlation Coefficient, Rank Correlation, Regression.

TEXT BOOKS

1. R. E. Walpole, S. L. Myers, and K. Ye, *Probability and statistics for engineers and scientists*, 8th Edition, Pearson. [Chapter- **2**, **3**(3.1 – 3.4), **4**(4.1 – 4.3), **5**(5.3 and 5.6), **6**(6.1 – 6.5), **8**(8.1, 8.2, 8.4 – 8.7), **9**(9.1 – 9.6, 9.12), **10**(10.1 – 10.7, 10.14)]
2. S. C. Gupta, V. K. Kapoor, *Fundamental of Mathematical Statistics*, 10th revised edition, Sultan Chand & Sons. [Chapter- **10**(10.1 – 10.7)]

REFERENCE BOOKS

1. J. E. Freund, *Mathematical Statistics*, 5th Edition, Prentice Hall of India pvt. Ltd., Eastern Economy Edition.
2. D. C. Montgomery and G. C. Runger, *Applied Statistics and Probability for Engineers*, 6th Edition, Wiley.
3. R. C. Johnson, *Probability and Statistics for Engineers*, 6th Edition, Prentice Hall of India pvt. Ltd., Eastern Economy Edition.

COURSE OUTCOMES

On completion of this course, students are able to:

CO-1: Use the basic probability rules, discrete and continuous probability distributions, including requirements of mean and variance.

CO-2: Identify the characteristics of different discrete and continuous distributions. Identify the type of statistical situation to which different distributions can be applied.

CO-3: Use of continuous distribution and various hypothesis of testing.

CO-4: Employee the principles of linear regression and correlation and significance of the correlation coefficient.

22MC206	Object Oriented Programming using JAVA Lab	2 Credits

Course Objective:

1. Learn and implement Programs with the syntax, semantics and idioms of the Java programming language.
2. Gain confidence in object-oriented programming principles through lots of practical exercises that provide useful exposure to the core Java class libraries.
3. Students will able to learn about. Multi-Threading, String Handling and Java I/O.
4. Students will Develop and implement Graphical User Interface(GUI) Applications in Java using AWT and Swing

Lab Assignments

1. Data types & variables, decision control structures: if, nested if etc Loop control structures: do, while, for etc.
2. Classes and objects.
3. Data Abstraction & Data hiding, Inheritance.
4. Interfaces and inner classes, wrapper classes.
5. Exception handlings
6. Threads
7. IO Files

8. Collections
9. Database Connectivity.
10. Applets AWT and Swing.

Course Outcome:

1. Understand and implement various Object-Oriented Concepts like inheritance, abstraction and polymorphism.
2. Work with Collection Classes and Files, Multiple Threads, & handle Exceptions.
3. Develop applications to interact with a Database.
4. Design and implement Graphical User Interface (GUI) Applications in Java using AWT and Swing.

22MC207	Computer Network Lab (0-0-4)	2 Credits

Course Objective:

1. Understand the concepts of data communication, layered model, wireless devices in computer networks.
2. Students will be able to understand the various techniques used to access a shared channel in the network and IEEE specifications for LANs.
3. Students will learn about different types of networking devices, backbone networks and Internet Protocol (IP)addressing.
4. Understand the responsibilities of network, transport and application layers.

Lab Assignments

1. Introduction to LAN hardware and IP addresses configuration

2. Understanding and use of networking tools: ifconfig, ping, traceroute, arp, dig and nslookup

3. Configuration of CISCO Switches and Routers.

4. Study of network traffic using Wireshark filters.

5. Controlling of network scenario using Netam and tc.

6 to 8 are based on the following experiments:

i. Simulate a three node point to point network with duplex links between them. Set queue size and vary the bandwidth and find number of packets dropped.

ii. Simulate a four node point to point network with the links connected as follows: n0 – n2, n1 – n2 and n2 – n3. Apply TCP agent between n0 – n3 and UDP agent between n1 – n3. Apply relevant applications over TCP and UDP agents changing the parameter and determine the number of packets sent by TCP / UDP.

iii. Simulate the transmission of ping messages over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.

iv. Simulate an Ethernet LAN using 'n' nodes, change error rate and data rate and compare throughput.

v. Simulate an Ethernet LAN using 'n' nodes and set multiple traffic nodes and plot congestion window for different source / destination.

9 to 10 are based on the following experiments to be implemented in C/Java:

i. Implementation of Distance Vector Algorithm to find suitable path for transmission.

ii. Program for ERROR detecting code using CRC-CCITT (16bit).

iii. Using TCP/IP Sockets, write a client-server program to make client sending the file name and the server to send back the contents of the requested file if present.

iv. Program for CLIENT SERVER communication using message Queues or FIFOs as IPC channels that client sends the file name and the server to send back the contents of the requested file if present.

v. Program for Congestion control using Leaky Bucket Algorithm.

22MC208	Operating System Lab (0-0-4)	2 Credits

Course Objective:

1. To write UNIX shell scripting.
2. To understand and implement IPC mechanism using named and unnamed pipes.
3. To implement the scheduling algorithms.
4. To develop solutions for synchronization problems using semaphores.
5. To implement Deadlock avoidance algorithms.
6. To implement page replacement algorithms

Lab Assignments

1. Practicing of basic UNIX Commands as well as Linux administrative commands 2. UNIX Shell Programming covering array, string and functions

3. Shell scripting using GREP commands.
4. Shell scripting using AWK commands.
5. Inter Process Communication (IPC) using Pipes.
6. Programs on signals and system calls
7. Implement the algorithms of CPU scheduling algorithms like FCFS, SJF, SRTF, Priority and RR using C/C++.
8. Write C/C++ programs to implement the classical synchronization problems like Dinning Philosopher and reader-writer problems using semaphore.
9. Implementation of deadlock avoidance algorithm using C/C++.
10. Implementation of page replacement algorithms like FIFO, LRU and Optimal.

Suggested Books:

1. Jain S,Pillai V, Kratika, Rai A, Basics of OS, UNIX and SHELL Programming, BPB Publication, 2017

2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System concepts, 8th edition, Wiley-India, 2009
3. Andrew S. Tanenbaum: Mordern Operating Systems, 4th Edition, Pearson Education, 2014.

22MC209	Personality and Soft Skill Development (0-0-4)	2 Credits

1. Soft Skills – Self Analysis, Creativity, Attitude, and Goal Setting
2. Personality development - Interpersonal Skills, Leadership Skill, and Decision making
3. Business Writing- Structure and Impact of Business writing
4. Etiquette and Manners – Modern Etiquette, Benefits, Social Manners and Corporate Grooming
5. Stress Management - Kinds of Stress, Spotting stress, Emotional intelligence and managing emotions
6. Group Discussion – Group Dynamic, Lateral Thinking, Brainstorming and Negotiation Skills
7. Team Skills- Team Structure and Team Dynamic
8. Interview Skills – Concept and Process of Interview, Pre-preparation and Answering Strategies
9. Presentation Skills – Planning, Practicing and Delivering Presentation
10. Conflict Resolution – Conflict in Human Relations, Approaches to conflict resolutions.