Syllabus

Master of Computer Application (MCA)

(2020-2022 Batch)

NATIONAL INSTITUTE OF SCIENCE & TECHNOLOGY (AUTONOMOUS),

Institute Park, Pallur Hills, Berhampur, Odisha, India – 761008

MCA Programme Structure (2020-2022 Batch)

First Semester					
Theory					
Sl. No	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**
1	IT	20MC101	Data Structure using C	3-0-0	3
2	IT	20MC102	Computer Organization and Architecture	3-0-0	3
3	BM	20MC103	Principles and Practice of Management	3-0-0	3
4	MATH	20MC104	Mathematics – I: (Numerical Methods & Quantitative Tech.)	3-0-0	3
5	BM	20MC105	Communicative English	2-0-0	2
6	BM	20MC106	Environmental Science	3-0-0	0
Total Credit (Theory)					14
Practical					
1	LAB	20MC107	Data Structure Lab	0-0-3	2
2	LAB	20MC108	Computer Organization and Architecture Lab	0-0-3	2
3	LAB	20MC109	Communicative English Lab	0-0-3	2
6	SEM	20MC110	Seminar/PPT	0-0-1	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	20MC201	Object Oriented Programming using JAVA	3-0-0	3
2	IT	20MC202	Computer Networks	3-0-0	3
3	IT	20MC203	Operating Systems	3-0-0	3
4	IT	20MC204	Software Engineering	3-0-0	3
5	MATH	20MC205	Mathematics - II	3-0-0	3
Total Credit (Theory)					15
Practical					
1	LAB	20MC206	Object Oriented Programming Lab	0-0-3	2
2	LAB	20MC207	Computer Networks Lab	0-0-3	2
3	LAB	20MC208	Operating Systems Lab	0-0-3	2
4	LAB	20MC209	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	20MC301	Design Analysis and Algorithms	3-0-0	3
2	IT	20MC302	Database Management Systems	3-0-0	3
3	IT	20MC303	Python Programming	3-0-0	3
4	IT	20MC304	Software Testing and Quality Assurance	3-0-0	3
5	IT	20MC305 20MC306 20MC307 20MC308 20MC309	Elective I Computer Graphics and Multimedia/ Data and Web Mining/ Mobile Computing/ NLP/ IT Infrastructure Design	3-0-0	3
Total Credit (Theory)					15
Practical					
1	LAB	20MC310	Design Analysis and Algorithms Lab	0-0-3	2
2	LAB	20MC311	Database Management System Lab	0-0-3	2
3	LAB	20MC312	Python Programming Lab	0-0-3	2
4	PROJ	20MC313	Minor Project	0-0-3	6
5	SEM	20MC314	Summer Internship	0-0-2	1
Total Credit (Practical)					13
Total Semester Credit					28

Fourth Semester					
Theory					
Sl. No.	**Category**	**Course Code**	**Course Title**	**L-T-P**	**Credit**
1	IT	20MC401	AI and ML using Python	3-0-0	3
2	IT	20MC402	Enterprise Web Computing with JAVA (EWCJ)	3-0-0	3
3	IT	20MC403 20MC404 20MC405 20MC406 20MC407	Elective II Internet of Things (IoT)/ Distributed System/ Big Data Analysis/Data Science/ Computer Network Security/ Software Evaluation	3-0-0	3
Total Credit (Theory)					9
Practical					
1	LAB	20MC408	AI and ML using Python Lab	0-0-3	2
2	LAB	20MC409	Enterprise Web Computing with JAVA (EWCJ) Lab	0-0-3	2
3	PROJ	20MC410	Major Project / Industrial Training	0-0-4	16
Total Credit (Practical)					20
Total Semester Credit					29

Math – I

i. Numerical Methods
ii. Quantitative Tech.

Math – II

i. Discrete Math

Elective I

i. Computer Graphics and Multimedia
ii. Data and Web Mining
iii. Mobile Computing
iv. NLP
v. IT Infrastructure Design

Elective II

i. Internet of Things (IoT)
ii. Distributed System
iii. Big Data Analysis/Data Science
iv. Computer Network Security
v. Software Evaluation

ATTP:

i. Web Development
ii. Mobile App Development

20MC101	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.

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

20MC102	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 analyze the performance differences of computing evolution on basic operation like addition, multiplication and division, page replacement algorithms and cache memory mappings.

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. Describe the fundamental organisation of a computer system
2. Explain the functional units of a processor
3. Explain addressing modes, instruction formats and program control statements
4. Distinguish the organization of various parts of a system memory hierarchy
5. Describe basic concept of parallel computing
6. Describe fundamentals concepts of pipeline and vector processing

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.

20MC103	Principles and Practices of Management (3-0-0)	3 Credits

Course Objective:

1. To study the functions and principles of management.
2. To learn the application of the principles in an organization.
3. To enable the effective and barriers communication in the organization ·
4. To study the system and process of effective controlling in the organization

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

Nature and functions of Management: What Managers do? Definition, Management as a Science, Art, Profession, Levels of Managers, Management Process, Skills of Managers, Role of Managers. Scientific Management Theory (Taylo*r)*, Administrative Management Theory (Fayol), Behaviouristics Management (Mayo). Systems Theory, Contingency Management theory.

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

Planning Nature and Purpose of Planning, Planning Process, Principles of Planning, Types of Planning, Advantages and Limitations of Planning and Effective Planning. Organizing: Nature and Purpose of Organizing, Key components of organizing, Bases of Departmentation, Span of Management and its determinants, Line and Staff Relationship, Line-Staff Conflict, Bases of Delegation, Kinds of Delegation and Decentralization.

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

Staffing: Importance, manpower planning, Recruitment and selection, Training and Development, Performance appraisal. Leadership: Different sources of power, Management and leadership Approaches to leadership and styles.

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

Controlling: Concept and Process of Control, Control Techniques, Human Aspects of Control, Control as a Feedback System, Feed Forward Control, Preventive Control, Profitand Loss Control, Control Through Return on Investment, The Use of Computer for Controlling and Decision Making, The Challenges Created by IT as a Control Tool. Decision Making Process, Individual Decision-Making Models.

Module- V: (as per choice of faculty) **(6 Hrs.)**

Portion covered can be tested through Internal evaluation only not to be included in University examination)

Course Outcomes:

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

1. Explain the importance of employee motivation in an organization.
2. Explain needs-based theories of motivation.
3. Explain process-based theories of motivation.
4. Describe the job characteristics that affect motivation.

Reference Books:

1. Stephen P. Robbins, David A. Decenzo, Sanghmitra Bhattacharya, Madhushree Nanda Agarwal, Fundamentals of Management, Pearson Education, 2009
2. Kreitner, Management Theory and Applications, Cengage Learning, India, 2009
3. Robbins, Management, 9th edition Pearson Education, 2008,
4. Griffin, Management Principles and Applications, Cengage Learning, India First Edition
5. Harold Koontz, O'Donnell and Heinz Weihrich, Essentials of Management. New Delhi, Tata McGraw Hill, 2006
6. Stoner, Management, PHI Learning, 2008
7. Richard L. Daft, Principles Of Management, CengageLearning,India, 2009
8. Principles of Management, Meenakshi Gupta, PHI
9. Principles of Management, RN Gupta, S.Chand

Course Name	Principles and Practices of Management
Course Link	https://nptel.ac.in/courses/110/107/110107150/
Course Instructor	Prof. Usha Lenka Department of Management studies Indian Institute of Technology Roorkee

Course Name	Principles and Practices of Management
Course Link	https://nptel.ac.in/courses/110/105/110105146/
Course Instructor	Prof. Susmita Muhopadhyay and Prof. S Srinivasan Vinod Gupta School of Management IIT Kharagpur

Online Course Material	https://courses.modernstates.org/courses/course-v1:ModernStatesX+MGM1+2016_T4/7e9faabd2ef540bdbf0b071531bd2985/

20MC104	Mathematics - I (3-0-0)	3 Credits

Course Objective:

i. To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems.
ii. To understand the concept of accuracy and precision with examples.
iii. To locate roots of the equations by using Bisection method.
iv. To understand one point iterative method to find appropriate roots. To Know the open method like Newton-Raphson Method and Secant method
v. To understand various skills like interpolation, numerical integration and solution of differential equation.
vi. To introduce students the use of quantitative methods & techniques for effective decision making
vii. Model formulation.
viii. Application that are used in solving business decision problems.
ix. Decision to maximize profit and minimize loss.
x. Taking decision involving queuing lines.
xi. To handle project planning effectively.

Module-I: **(10 Hours)**

Numerical Method-1: Approximations and Errors in Computation. Root finding methods: Bisection, Newton Raphson and Secant methods. Interpolation: Newton Divide Difference, Lagrange Method and System of linear equations: Gauss elimination method, Gauss Seidal method. Eigen values & Eigen vectors.

Module-II: **(07 Hours)**

Numerical Method-2: Integration: Trapezoidal, Simpson's 1/3 rule &Gauss Quadrature methods for two and three point. Ordinary differential equations of First order by Euler's, Modify Euler's &Runge-Kutta Methods.

Module-III: **(08 Hours)**

Operation research-1: ntroduction to Linear Programming Problem: Formulation of LPP. Solution of LPP by: Graphical, Simplex, Big-M ,Dual Simplex Methods. Integer Linear Programming by Branch and Bound Method.

Module-IV: **(08 Hours)**

Operation reseach-2: Transportation Problem: Mathematical formulation, initial basic feasible solution, test for optimality solution by MODI Method, degenracy, unbalanced

transportation problem. Assignment Problem: Mathematical formulation, method of solving assignment problem and solution by Hungarian method, maximization assignment problem. Introduction to Queuing Theory: Characteristics of queuing models, solution to single channel with poisson arrivals and exponential service with finite and infinite population models:- $(M/M/1):(\infty/FCFS)$,$(M/M/1):(N/FCFS)$

Module-V: Operation research-3 **(07 Hours)**

Project Management: Visual display of a project, scheduling a project with PERT/CPM, dealing with uncertain activity, Time-cost trade-offs, Scheduling and controlling project costs, evaluation of PERT/CPM.

Test Books:

1.M. K. Jain, S.R.K. Iyenger and R.K. Jain,″ Numerical Methods for Scientific and engineering Computations″ , New age International Publication (P) Ltd.
2. P.K. Gupta and D.S.Hira **Operations Research**, S CHAND.

Reference Books:

1. S.S. Sastry, ″Introductory Numerical Methods″, Prentice Hall India Ltd.
2. Operations Research, Hiller, Libwerman, 8th edition TMH 2005.
3. Operation Rearch, Panneerselvam, PHI

20MC105	Communicative English (3-0-0)	3 Credits

Course Objective:

1. To enhance the learner's communication skills by giving adequate exposure in LSRWlistening, speaking, reading and writing skills and the related sub-skills.
2. To impart better writing skills by sensitizing the learners to the dynamics of effective writing.

Module- I: Basics of communication skills (8 Hrs.)

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, Paralingustics, The importance of audience & purpose

Module- II: Basics of English pronunciation & Soft Skills (10 Hrs.)

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

Module- III: Brush up your Grammar & Vocabulary (6 Hrs.)

Parts of speech &Tense, Concord, Parallelism, Word formation- root words, synonyms, antonyms, homonyms & homophones, Common errors in English Grammar.

(N.B. – Instead of teaching, this unit should be taught by assigning activities to the students in the class)

Module- IV: Basics of reading and writing skills (6 Hrs.)

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.

Module- V: Professional writing (10 Hrs.)

Paragraph, Letter, Memos & Circulars, Reports, Proposals, e-mails & CV.

Course Outcomes:

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

1. develop vocabulary and improve the accuracy in grammar.
2. produce words with right pronunciation.
3. Improve LSRW- listening, speaking, reading and writing skills and the related sub-skills.

demonstrate positive group **communication** exchanges

Reference Books:

1. Communication Skills by Sanjay Kumar and Pushp Lata, Oxford University Press
2. Technical Communication, Principle and Practice by Meenakshi Raman & Sangeeta Sharma, Oxford University Press
3. Effective Technical Communication, M Ashraf Rizvi, Tata Mc Graw – Hill.
4. Business Communication, Meenakshi Raman &Prakash Singh, 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, S Chand

Suggested Readings:

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

20MC106	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

Module – I **(10 Hrs.)**

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 **(10 Hrs.)**

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: pretreatment, 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 **(10 Hrs.)**

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 **(10 Hrs.)**

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.

20MC107	Data Structure Lab (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.

20MC108	Computer Organization and Architecture Lab (0-0-4)	2 Credits

Laboratory Experiments

1.

(a) Identification of different components of a PC.

(b) Assembling & disassembling of a PC.

2. Study of different troubleshooting of a dot matrix printer using LX 1050+ Printer Trainer

Module.

3. Study of the functions of SMPS using SMPS Trainer Kit.

(a) Study of SMPS with Single Output under Line Regulation.

(b) Study of SMPS with Multi Output under Line Regulation.

(c) Study of SMPS with Single Output under Load Regulation.

4. Study of different troubleshooting of CPU using CPU Trainer Module.

5. Familiarization of different types of byte addressing instruction using 8085 simulator.

6. Study of assembly Language program in PC using 8086 architecture.

7. Design of digital circuits (H/A, F/A, Decoder & Encoder) in VHDL using Active VHDL.

8. Design of digital circuits (MUX, DEMUX & ALU) in VHDL using Active VHDL.

9. Write a C/C++ program to perform signed bit multiplication using Booth's algorithm.

10. Write a C/C++ program for IEEE-754 floating point representation and perform Addition/Subtraction.

20MC109	Communicative English Lab (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

20MC201	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.

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

20MC202	Computer Network (3-0-0)	3 Credits

Course Objective:

1. Understand the concepts of data communication, layered model, wireless devices in computer networks.
2. Explain the various techniques used to access a shared channel in the network and IEEE specifications for LANs.
3. List types of networking devices, backbone networks and Internet Protocol (IP)addressing.
4. Explain 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, Digital Transmission: Digital-to-Digital conversion, Analogto-Digital conversion, Transmission modes, Analog Transmission: Digital-to-Analog conversion, Analog-to-Analog conversion, 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. Explain computer network reference models, networking devices and different transmission techniques.
2. Reason the need for flow and error control at the data link layer and explain the associated protocols; enumerate the shared channel access methods, associated protocols and Wired LAN standards and implementations.
3. Explain how network layer, transport layer and application layer facilitates the transfer of message from one node to another in a global network.

Suggested Books and Online Resources:

1. Data Communications and Networking, Behrouz A. Forouzan, Tata McGraw-Hill, 5th Edition(2013).
2. Computer Networks, A. S. Tannenbum, D. Wetherall, Pearson Education, 5th Edition(2014).
3. Data and Computer Communications, William Stallings, Pearson Education, 10th Edition(2018).
4. Computer Networking, A Top-Down Approach, James F. Kurose, Keith W. Ross, Pearson publication, 6th Edition(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 Instructor	Prof. Soumya Kanti Ghosh, 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

20MC203	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. The students will implement solutions via C/C++ programs.

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. 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.

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

20MC204	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
3. 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. Design UML diagram for given problem scenario
2. Translating a plan text problem to functional requirements.
3. Evaluation of software models for specific problems

Suggested Books:

1. Roger S. Pressman, Bruce R. Maxim,Software Engineering-A practitioner's approach- McGraw-Hill International Editions, New York. ISBN: 9789353165710, 9353165717, Edition: 8, 2019
2. RajibMall, *Fundamentals of Software Engineering*-, PHI, New Delhi. 5th Edition, 2018
3. Ian Sommerville Software Engineering-, Pearson Education, New Delhi, 10th Edition 2017, ISBN: 9789332582699
4. Pankaj Jalote , An Integrated Approach to Software Engineering-, Narosa Publishing House. Third Edition, 978-81-7319-702-4, Reprint 2019
5. UgrasenSuman Software Engineering: Concepts & Practices, Cengage Learning publications. 1st Edition, 2013.

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,

20MC205	Mathematics - II (3-0-0)	3 Credits

Module-1: Mathematical Logic **(08 Hours)**

Propositions and logical operators, truth table, logical connectives, conditionals and biconditionals, logical equivalence, predicate calculus.

Module-2: Graph Theory-1 **(8 Hours)**

Basic terminology, Eulerian paths and circuits, Hamiltonian paths and circuits, planer graph, graph coloring

Module-3: Graph Theory-2 **(8 Hours)**

Trees: definition and properties, tree traversals- preorder, inorder, postorder, binary trees, spanning trees, minimum cost spanning trees-Prim's and Kruskal's algorithm.

Module-4: Random Variable **(8 Hours)**

Definition of random variable, discrete and continuous probability distribution, mathematical expectation, variance and co-variance of random variables, binomial and Poisson distribution, uniform, normal, exponential distribution, Weibull's distribution.

Module-5: Statistics **(8 Hours)**

Methods of sampling, Estimation: point & interval estimation of parameters mean and standard deviation, Testing of hypothesis: Setting of hypothesis, null hypothesis & alternate hypothesis, Type-I & Type-II errors, critical region, confidence interval, level of significance, one sided & two sided tests, correlation analysis, regression analysis, fitting straight lines.

Extra topics to be covered at college level:

Introduction, definitions of probability, probability of an event, addition rule & multiplication rule, conditional probability, Bayes' rule.

Course Outcomes:

The students *will be able to:*

1. Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Understand basic properties of graphs and related discrete structures and relate these to practical examples.
3. Learn basic probability axioms and rules and the moments of discrete and continuous random variables as well as be familiar with common named discrete and continuous random variables.
4. Translate the real-world problems into probability and statistical models

Text Books:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers & Keying Ye, “Probability & Statistics for Engineers & Scientists", Eighth Edition, 2007, Pearson Education Inc., New Delhi.

2. Kenneth H. Rosen “Discrete Mathematics and Its Applications”, Tata McGraw Hill, FourthEdition, 2002 (Unit 1,2 & 3).

Reference Books:

1. C. L. Liu, D. P. Mohapatra, “Elements of Discrete Mathematics: A computer Oriented Approach”, McGraw Hill Education (India) Private Limited, 4th Edition, 2013.

2. Jay L. Devore, “Probability and Statistics for Engineering and Sciences”, Seventh Edition, Thomson/CENGAGE Learning India Pvt. Ltd.

20MC206	Object Oriented Programming using JAVA Lab	2 Credits

Course Objective:

Learn and implement Programs with 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.

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.

20MC207	Computer Network Lab (0-0-4)	2 Credits

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.

20MC208	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.

20MC209	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.

20MC301	Design Analysis and Algorithms (3-0-0)	3 Credits

Course Objective:

1. Translating a plain text problems to convert into an algorithm
2. Calculate best case, worst case time complexity and space complexities of different algorithm and choosing the best solution from the available options
3. Applying different design paradigm to solve different problems and comparing their best case, worst case scenarios.
4. Designing and applying different data structures over different algorithms for solving different problems.
5. Understand different P-class, NP class problems.

Module-I: **(12 Hrs.)**

Introduction to problems and algorithms, Mathematics for algorithm analysis , Insertion sort Analysing algorithms, Designing of algorithms, Asymptotic notation Standard notations and common functions, Recurrence relations, The substitution method, The recursion-tree method, The master method, Divide and conquer: Min-Max Heap, Priority queue, Heapsort , Quicksort, Merge Sort, Sorting in Linear Time: Lower bounds for sorting: Counting sort, Radix sort, Bucket sort, Fast Fourier transform ,

Finding the convex hull: Graham Scan, Finding the closest pair of points

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

Greedy method: Elements of the greedy strategy, Huffman codes, task-scheduling problem, Fractional Knapsack problem, Coin change problem, Dynamic programming: Assembly-line Scheduling, Matrix-Chain Multiplication, Longest Common Sub-sequence (LCS), 0/1 Knapsack problem, Rod Cutting problem

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

Graph algorithms: Basic Definitions and Application, Representations of graphs, Breadth-first search and Depth-first search, Data Structures for Disjoint Sets, strongly connected components, Minimum Spanning Trees: The algorithms of Kruskal and Prim

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

Single-Source Shortest Paths: The Bellman-Ford algorithm, Dijkstra's algorithm, All Pairs Shortest Paths-Shortest paths and matrix multiplication, The Floyd-Warshall algorithm

String Matching: The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm

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

Network Flow: Flow networks, The Ford-Fulkerson method, Maximum bipartite matching

Backtracking – n-Queen problem – Hamiltonian Circuit Problem – Subset Sum Problem.

Branch and Bound – LIFO Search and FIFO search – Assignment problem – Knapsack Problem, NP-Completeness: Classes P and NP, NP-complete problems.: Reduction of 3SAT to Subset Sum, Approximation Algorithm for TSP

Course Outcome:

1. Given a English language problem description define the problem precisely with input/output requirements, examine its inherent complexity and develop a generic or set of initial solutions and justify their correctness.
2. Given an algorithm description, analyse the time and space complexity of the algorithm in the worst case, average case, and amortized scenario as needed in terms of asymptotic order of complexity.
3. Given a problem definition explore different alternative algorithmic solutions, compare them with respect to time and space complexity and choose the design scheme and /or design parameter and data structure appropriately to obtain the best possible choice(s) that can be converted to an executable program.
4. Examine and prove whether a problem is of polynomial complexity, hard (np complete) or otherwise and develop optimal and approximate algorithm for them as applicable.

Suggested Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, MIT Press/McGraw-Hill, 2009.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.
3. SanjoyDasgupta, Christos H. Papadimitriou and Umesh V. Vazirani, Algorithms, McGraw-Hill, 2008.
4. Jon Kleinberg and ÉvaTardos, Algorithm Design, Addison-Wesley/PEARSON EDUCATION-2006.
5. S. Sridhar, ―Design and Analysis of Algorithms‖, Oxford university press, First Edition, 2015.

Course Name	DESIGN AND ANALYSIS OF ALGORITHMS
Course Link	https://nptel.ac.in/courses/106101060/
Course Instructor	Prof. Abhiram G Ranade, Prof. Ajit A Diwan, Prof. Sundar Viswanathan, IIT Bombay

Course Name	DESIGN AND ANALYSIS OF ALGORITHMS
Course Link	https://nptel.ac.in/courses/106106131/
Course Instructor	Prof. Madhavan Mukund, Chennai Mathematical Institute

Course Name	DESIGN AND ANALYSIS OF ALGORITHMS
Course Link	https://online.stanford.edu/courses/cs161-design-and-analysis-algorithms
Course Instructor	Reyna Hulett, CS161, Stanford School of Engineering,

20MC302	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-I: **(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-II: **(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 subqueries, 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-III: **(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-IV: **(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-V: **(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 solutions for different real life problems
2. Write efficient and optimised SQL queries
3. Designing and differentiating solutions using schema based database and NoSQL database methods.

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

Course Name	Database Management Systems
Course Link	*https://onlinecourses.nptel.ac.in/noc18_cs15/preview*
Course Instructor	Prof. Partha Pratim Das, Department of Computer Science & Engineering, IIT Kharagpur

Course Name	Database Management Systems
Course Link	*https://nptel.ac.in/courses/106104135/*
Course Instructor	Prof. Arnab Bhattacharya, IIT Kanpur

Course Name	Database Management Systems
Course Link	*https://in.udacity.com/course/database-systems-concepts-design--ud150*
Course Instructor	Dr. Leo Mark, Georgia Institute of Technology

20MC303	Python Programming (3-0-0)	3 Credits

Course Objective:

1. To acquire programming skills in core Python.
2. To acquire Object Oriented Skills in Python
3. To develop the skill of designing Graphical user Interfaces in Python
4. To develop the ability to write database applications in Python

Module-I

Python: Features of Python , Installing Python for windows and setting up paths, writing and Executing of a python programs, Python Virtual machine, Frozen binaries, Comparison between C, Java and python , Comments , Docstrings ,How python sees variables, Data types in Python, built in types, sequences in python, sets, literals in Python, user defined data types, identifiers & reserved words, Naming convention in python,

Module-II

various Operators in Python, Input & Output, Control statements, if statements, while loop, for loop, infinite loop, nested loop ,else suit, break, continue, pass ,assert, return statements, command line arguments.

Arrays in python, advantages using arrays, creating arrays, importing the array module, indexing and slicing on arrays, Processing the arrays, Comparing arrays.

Strings in Python, Creating strings, Length of a string, Indexing in strings, Slicing strings, Concatenation and Comparing strings,Finding SubStrings, Replacing a String.

Module-III

Functions in Python, define a function, calling a function, return from function, pass by object Reference, Positional arguments, Default arguments, Recursive functions.

Introduction to OOP, features of OOP, creating classes, the self-variable, constructor, types of variables, namespaces, types of methods.

Module-IV

Inheritance: Define inheritance, types of inheritance, constructors in inheritance, overriding super class constructors & methods, the super() method, MRO

Polymorphism: Duck typing philosophy of Python, operator overloading, method overriding, interfaces in python

Exceptions: Errors in a python program, Exceptions, Exception handling, Types of Exceptions, The Exception block, the assert statement, user defined exceptions

Python Database Connectivity: DBMS, types of databases used with Python, installation of MySQL database, setting path, verifying MySQL , installing MySQL connector, Working with MySQL database, Using MySQL from python, retrieving rows ,deleting rows, updating rows in a table.

Text Books

1. T. Budd, Exploring Python, TMH, 1st Ed, 2011.
2. Core Python Programming, Dr. R. Nageswar Rao , Dreamtech Press
3. Python Programming for Absolute Beginners, Michael Dawson, CENGAGE Learning

Reference Books

1. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012

Course Name	Python Programming
Course Material Link	Python Tutorial/Documentation www.python.or 2015
Course Material Link	http://docs.python.org/3/tutorial/index.html
Course Material Link	http://interactivepython.org/courselib/static/pythonds

20MC304	Software Testing and Quality Assurance (3-0-0)	3 Credits

Course Objective:

1. Introduce basic concepts of software testing
2. Understand white box, block box, object oriented, web based and cloud testing
3. Know in details automation testing and tools used for automation testing
4. Understand the importance of software quality and assurance software systems development.

Module-I

Quality Revolution, Software Quality, Role of Testing, Verification and Validation, Failure, Error, Fault and Defect, Notion of Software Reliability, Objective of Testing, What is a Test Case?, Expected Outcome, Concept of Complete Testing, Testing Activities, Test Oracle, Testing Levels, Regression Testing, White-Box and Black Testing, Test Planning and Design, Monitoring and Measuring Test Execution, Test Tools and Automation

Unit Testing: Concept of Unit Testing, Static and Dynamic unit Testing, Mutation Testing, Debugging, Unit Testing in eXtreme Programming.

Module-II

Control Flow Testing: Outline of Control Flow Testing, Control Flow Graph, Path in a CFG, Path selection Criteria, All-Path Coverage Criterion, Statement Coverage Criterion, Branch Coverage Criterion, Generation of Test Input, Example of Test Data Selection.

Data Flow Testing: Data Flow Anomaly, Overview of Dynamic Data Flow Testing, Data Flow Graph, Data Flow Terms, Data Flow Testing Criteria, Comparison of Data Flow Test Selection Criteria, Feasible Paths and Test Selection Criteria, Comparison of Testing Techniques.

System Integration Testing: Concept of Integration Testing, Different Types of Interfaces and Interface Errors, Granularity of System Integration Testing, System Integration Techniques, Software and Hardware Integration, Test Plan for System Integration, Off-the-Shelf Component Integration, Off-the-Shelf Component Testing, Built-in Testing

Module-III

System Test Categories: Basic Tests, Functionality Tests, Robustness Tests, Interoperability Tests, Performance Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Documentation Tests.

Functional Testing: Equivalence Class Partitioning, Boundary Value Analysis, Decision Tables, Random Testing, Error Guessing, Category Partition.

System Test Planning and Automation: Structure of a System Test Plan, Introduction and Feature Description, Assumptions, Test Approach, Test Suite Structure, Test Environment, Test Execution Strategy, Test Effort Estimation, Scheduling and Test Milestones, System Test Automation, Evaluation and Selection of Test Automation Tools, Test Selection Guidelines for Automation, Characteristics of Automated Test Cases, Structure of an Automated Test Case, Test Automation Infrastructure.

Acceptance Testing: Types of Acceptance Testing, Acceptance Criteria, Selection of Acceptance Criteria, Acceptance Test Plan, Acceptance Test Execution, Acceptance Test Report, Acceptance Testing in eXtreme Programming.

Module-IV

Software Reliability: Definition, Factors Influencing Software Reliability, Application of Software Reliability, Operational Profiles.

Software Quality: Five Views of Software Quality, McCall's Quality Factors and Criteria, Quality Factors Quality Criteria, Relationship between Quality Factors and Criteria, Quality Metrics, ISO 9126 Quality Characteristics, ISO 9000:2000 Software Quality Standard ISO 9000:2000 Fundamentals, ISO 9001:2000 Requirements.

Maturity Models: Basic Idea in Software Process, Capability Model(CMM) Model, Architecture, Five Levels of Maturity and Key Process Areas, Common Features of Key Practices, Application of CMM, CMMI, Test Process Improvement (TPI), Testing Maturity Model (TMM).

Textbook:

1. Software Testing and Quality Assurance: Theory and Practice, Kshirasagar (Sagar) Naik, University of Waterloo, Priyadarshi (Piyu) Tripathy, NEC, Wiley , 2008.

Reference Book:

1. Software Quality Assurance, Daniel Galin, Pearson Education

20MC306	Design Analysis and Algorithms Lab (3-0-0)	3 Credits

Lab Assignments

1. Insertion Sort/ Selection Sort
2. Divide and Conquer: Fibonacci search/Binary search
3. Divide and Conquer: Merge Sort/Quicksort/Heap Sort
4. Divide and Conquer: Convex hull/Finding closet pair
5. Dynamic Programming: MCM/LCS
6. Dynamic Programming: Rod Cutting problem /Assembly line Scheduling
7. Greedy method: Activity Selection/Huffman Coding
8. Graph Search: BFS/DFS
9. Graph Greedy MST: Kruskal/Prim's
10. Graph Greedy Shortest Path: Bellman ford/Dijkstra
11. Rabin Karp string matching algorithm/Subset Sum problem using Branch and Bound

Prerequisite: Each student should have a good knowledge on basic data structures like Stack, Queue, List, Heap, Matrix

20MC307	Database Management System Lab (3-0-0)	3 Credits

Lab Assignments

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)

20MC308	Python Programming Lab (3-0-0)	3 Credits

Lab Assignments

1. Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon users choice.

2. Write a Program to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria:

Grade A: Percentage >=80

Grade B: Percentage>=70 and <80

Grade C: Percentage>=60 and <70

Grade D: Percentage>=40 and <60

Grade E: Percentage<40

3. Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.

4. Write a Program to display the first n terms of Fibonacci series.

5. Write a Program to find factorial of the given number.

6. Write a Program to find sum of the following series for n terms: 1 – 2/2! + 3/3! - - - - - - n/n!

7. Write a Program to calculate the sum and product of two compatible matrices.

8. Install MySQL and connector. Write Python programs to retrie, inserting, delete, update rows in a table.

ELECTIVE-I

20MC305	Computer Graphics and Multimedia (3-0-0)	3 Credits

Course Objective:

1. To study the primary objective of this course is to learn the basic principles for representation of the geometric objects in the 2D and 3D coordinates. Utilize the computer system and methods
2. To learn the implement the algorithms and techniques necessary to produce geometric objects in 2D and 3D space illustrations.
3. To study the geometric optics necessary to determine how light bounces off surfaces. Shading algorithms to determine how a surface should be shaded to produce realistic illustrations. Curves and surfaces methods for rendering and shading curved objects.
4. The students will design and implement a substantial computer graphics system/project to represent some complex illustrations with the help of graphics system

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

Overview of Graphics System: Video Display Units, Raster-Scan and Random Scan Systems, Graphics Input and Output Devices. Output Primitives: Line drawing Algorithms: DDA and Bresenham's Line Algorithm, Circle drawing Algorithms: Midpoint Circle Algorithm and Bresenham's Circle drawing Algorithm.

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

Two-Dimensional Geometric Transformation: Basic Transformation (Translation, Rotation, Scaling) Matrix Representation, Composite transformations, Reflection, Shear, Transformation between coordinate systems. Two-Dimensional Viewing: Window-to- View Port Coordinate Transformation.

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

Clipping: Line Clipping (Cohen-Sutherland Algorithm) and Polygon Clipping (Sutherland-Hodgeman Algorithm), Aliasing and Antialiasing, Half Toning, Thresholding, Dithering. Polygon Filling: Seed Fill Algorithm, Scan line Algorithm. Two-Dimensional Object Representations: Spline Representation, Bezier Curves, B-Spline Curves. Fractal Geometry: Fractal Classification and Fractal Dimension.

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

3D Geometric and Modelling Transformations: Translation, Rotation, Scaling, Reflections, shear, Composite Transformation. Projections: Parallel Projection, Perspective Projection.

Visible Surface Detection Methods: Back-Face Detection, Depth Buffer, A- Buffer, Scan- Line Algorithm, Painters Algorithm.

Module-V: (8 Hrs.)

Illumination Models: Basic Models, Displaying Light Intensities. Color models: properties of light, XYZ, RGB, YIQ and CMY color models, Surface Rendering Methods: Polygon Rendering Methods: Gouraud Shading, Phong Shading. **Computer Animation:** Types of Animation, Key frame Vs. Procedural Animation, Methods of Controlling Animation, Morphing. Introduction to Virtual Reality and Augmented Reality.

Course Outcome:

1. Student will understand the basic principles for representation of the geometric objects in the 2D and 3D coordinates.
2. Student will learn the implement the algorithms and techniques necessary to produce geometric objects in 2D and 3D space illustrations.
3. Student will understand Shading algorithms to determine how a surface should be shaded to produce realistic illustrations. Curves and surfaces methods for rendering and shading curved objects.
4. The students will be able to design and implement a substantial computer graphics system/project to represent some complex illustrations with the help of graphics system.

Suggested Books:

1. Computer Graphics, C version; D. Hearn and M. P. Baker; Pearson Education, 2nd Edition, 2002
2. Computer Graphics Principle and Practice, J.D. Foley, A. Dam, S.K. Feiner, Addison Wesley, 4th Edition, 2014.
3. Procedural Elements of Computer Graphics, David Rogers, TMH. 1998

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

Instructor	Indian Institute of Technology Kharagpur

MOOC courses:

https://www.coursera.org/learn/interactive-computer-graphics by Takeo Igarashi (Professor) Department of Computer Science, Graduate School of Information Science and Technology, University of Tokyo.

ELECTIVE-I

20MC305	Data and Web Mining (3-0-0)	3 Credits

Course Objectives

1. Identify the scope and necessity of Data Mining and Knowledge Discovery.
2. To understand various tools of Data Mining and their techniques to solve the real time problems.
3. To develop ability to design various algorithms based on data mining tools.
4. To develop further interest in research and design of new Data Mining techniques.

Module I **(10 Hrs.)**

Knowledge Discovery in Databases (KDD) process: data integration, mining, and interpretation of patterns in large collections of data. Overall Architecture, Data Warehouse Database Sourcing, Data pre-processing techniques: Acquisition, Clean-up & Transformation Tools, Metadata data mining techniques for classification, regression, clustering, deviation detection, and association analysis; and evaluation of patterns mined from data.

Module II **(10 Hrs.)**

Data Warehousing Component, Defining Features, data warehouses and data marts, overview of the components, metadata in the data warehouse. OLAP in the Data Warehouse: Demand for Online analytical processing, need for multidimensional analysis, OLAP definitions and rules, OLAP characteristics, major features, dimensional analysis, hypercube. Drill-down and roll-up, slice-and-dice or rotation, OLAP models, overview of MOLAP model, ROLAP model, ROLAP versus MOLAP.

Module III **(12 Hrs.)**

Data Mining Basics: What is Data Mining, Data Mining Defined, The knowledge discovery process, OLAP versus data mining, data mining and the data warehouse, Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, Data Mining Applications, Benefits of data mining in industry, banking and finance.

Module IV **(6 Hrs.)**

Web mining: classifying web pages, extracting knowledge from the web, mining the World Wide Web, Spatial Data Mining, Multimedia Data Mining, Text Mining.

Text Book and Materials:

1. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining Concepts and Techniques", Third Edition, Elsevier.
2. Data Warehousing, Data Mining & OLAP by Alex & Stephen, McGraw Hill.
3. Vikram Pudi & P. Radha Krishna, Data Mining, Oxford University Press.
4. Reema Thareja, Data Warehousing, Oxford University Press.

Course Name	Data and Web Mining
Course Link	https://nptel.ac.in/courses/106/105/106105174/
Course Instructor	PROF. PABITRA MITRA Department of Computer Science and Engineering, IIT Kharagpur

Course Name	Data and Web Mining
Course Link	https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs12/
Course Instructor	

ELECTIVE-I

20MC305	Mobile Computing (3-0-0)	3 Credits

Course Objective:

1. Understand fundamentals of wireless communications.
2. Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.
3. Demonstrate basic skills for cellular networks design.
4. Apply knowledge of TCP/IP extensions for **mobile** and wireless networking.

Module - I **(6 Hours)**

Introduction to Personal Communications Services (PCS): PCS Architecture, mobility management, Networks signalling, Global System for Mobile Communication (GSM) System overview: GSM Architecture, Mobility management, Network signalling.

Module - II **(12 Hours)**

General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes, Mobile Data Communication; WLANs (Wireless LANs) IEEE 802.II standard, Mobile IP.Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark-up Languages (WML), Wireless Local Loop (WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.

Module - III **(6 Hours)**

Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) Vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000.

Module - IV **(10 Hours)**

Global Mobile Satellite Systems; case studies of the IRIDIUM, ICO and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. Server-side programming in Java, Pervasive web application architecture, Device independent example application.

Module - V **(6 Hours)**

Mobile Device Operating System, Commercial mobile operating systems, Software development kit, iOS, Android, Windows phones, M-Commerce, Mobile transaction system, related security issues, 4G technology, fundamental concepts of mobile cloud computing and different application instances.

Course Outcome:

1. Understand fundamentals of wireless communications.
2. Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.
3. Demonstrate basic skills for cellular networks design.
4. Apply knowledge of TCP/IP extensions for mobile and wireless networking.

Suggested Books and Online Resources:

1. J. Schiller: Mobile Communication, Pearson Education
2. Rajkamal: Mobile Computing, Oxford University Press.
3. Burkhardt: Pervasive Computing, Pearson Education.
4. Hansmann, Merk: Principles of Mobile Computing, 2nd Edition, Springer.
5. P. Stavronlakis: Third Generation Mobile Telecommunication Systems, Springer.
6. SandeepSinghal: The Wireless Application Protocol, Pearson Education.
7. http://ftp.mi.fu-berlin.de/pub/schiller/, Jochen Schiller, FreieUniversitätBerlinGermany

Course Name	Introduction to Mobile Computing
Course Link	https://nptel.ac.in/noc/courses/noc16/SEM2/noc16-cs13/
Course Instructor	Prof. Pushpendra Singh, IIIT-Delhi

ELECTIVE-I

20MC305	IT Infrastructure Design (3-0-0)	3 Credits

Course Objective

1. To develop a comprehensive knowledge of the functionality of networking hardware.
2. To acquire the skills to solve business problems that require IT solutions.
3. To develop the competency to investigate inter-organization and intra-organization communications problems and propose a viable technology solution.

UNIT I

Overview of Analysis, Architecture, and Design Processes: Process Components, Tactical and Strategic Significance, Hierarchy and Diversity, Importance of Network Analysis, Model for Network Analysis, Architecture, and Design

A Systems Methodology, System Description, Service Description, Service Characteristics: Service Levels, System Components and Network Services, Service Requests and Requirements, Service Offerings, Service Metrics.

Performance Characteristics: Capacity, Delay, RMA, Performance Envelopes, Network Supportability

Network Architecture: Component Architecture –Routing, Network Management, Performance, Security.

Architectural models: topological, flow model, Functional model.

UNIT II

Enterprise LAN Design: Ethernet Design Rule. 100 Mbps Fast Ethernet Design rules, gigabit Ethernet Design Rules, 10 Gigabit Ethernet Design rules, 10GE Media types

Understanding Working of Repeater, hub, Bridge, routers, Layer2/3 Switch,

Campus LAN Design Best Practice, Server Farm Design, Campus LAN QoS consideration, Multicast Traffic Consideration

UNIT III

Routing Protocol Characteristics, Static Versus Dynamic Route Assignment, Interior Versus Exterior Routing Protocols, Distance-Vector Routing Protocols, EIGRP, Link-State Routing Protocols, Distance-Vector Routing Protocols Versus Link-State Protocols, Hierarchical Versus Flat Routing Protocols, Classless Versus Classful Routing Protocols, Administrative Distance. Routing Protocol Metrics and Loop Prevention: Hop Count, Bandwidth, Cost, Load, Delay, Reliability, Maximum Transmission Unit,

Routing Loop-Prevention Schemes: Split Horizon, Poison Reverse, Counting to Infinity, Triggered Updates

RIPv2: Authentication, MD5 Authentication, RIPv2 Routing Database, RIPv2 Message Format, RIPv2 Timers, RIPv2 Design, RIPv2

RIPng: RIPng Timers, Authentication, RIPng Message Format, RIPng Design

OSPF: Metric, Adjacencies and Hello Timers, OSPF Areas,OSPF Router Types, OSPF DRs, LSA Types
EIGRP: Components, Neighbor Discovery and Recovery, Timers, Packet Types, Design

UNIT IV

Server-Centric IT architecture and its Limitations, Storage-centric IT Architecture and its Advantages.
Intelligent Disk Subsystems: Architecture, Storage Virtualization using RAID, RAID levels,
I/O Techniques: SCSI, Fibre Channel Protocol stack, Fibre Channel SAN, IP Storage.

UNIT V

Enterprise Wireless LAN Architecture: Components of Centralize Architecture: understanding 802.11X standards. WLAN technologies (Narrow Band, Spread Spectrum, FHSS, DSS) and topologies,
Wireless Network Components: Access Point and NICs, Router etc; WLAN enterprise design, WLAN performance, WLAN monitoring and troubleshooting, WLAN security. Intra and inter controller roaming.

Text Books:

1. Network Analysis, Architecture, and Design, James D. McCabe, 3rd Edition, Morgan Kaufman
2. CCDA Cisco official Guide
3. Storage Networks explained by Ulf Troppen, Wiley.
4. Storage Network Management and Retrieval by Dr. Vaishali Khairnar, Nilima Dongre, Wiley, India

20MC401	AI and ML using Python (3-0-0)	3 Credits

Course Objective:

1. To learn the concepts of Artificial Intelligence
2. To learn the methods of solving problems using Artificial Intelligence
3. To introduce the concepts of Machine learning procedure

Module-I: **(10 Hours)**

Intelligence and AI, Agents, Model of different types of agent: reactive, deliberative, goal-driven, utility-driven, and learning agents, Environment properties, Search Techniques - definition and importance, uninformed search – DFS, BFS, iterative deepening, depth limited search, Issues in design of heuristics, Best First search, A* and AO* search, Hill climbing, Constraint Satisfaction Problem, 8-puzzle problem.

Module-II: **(10 Hours)**

Uncertainty, type of uncertainty, Bayesian networks, supervised, unsupervised, reinforcement, induction learning, Bayesian learning, expectation maximization. Supervised Learning: Artificial Neural Network: Biological Motivation, ANN representation, ANN Problem selection, Perceptron, Multilayer Networks and the Backpropagation Algorithm, k-Nearest Neighbour Classifier, Support Vector Machine,

Module-III: **(10 Hours)**

Non-parametric learning, Clustering, clustering criterion, similarity measures, types of clustering, partition-based K-means, K-medoid, Clustering, Density Based Clustering, Cluster Validation (Inter-Intra Cluster Distance, Dunn Index) Dimensionality Reduction: Feature Extraction, Feature Selection – Feature Ranking and Subset Selection, Factor Analysis: Principal Component Analysis.

Module-IV: **(8 Hours)**

Model Selection criteria, No Free Lunch Theorem, Bias-Variance problem, Decision Tree Classifier, ensemble method of classifiers- bagging, boosting, assessment of classification system- confusion matrix, precision, recall, F-score, sensitivity, specificity, ROC analysis AUC analysis. Application of AI and ML to build diagnostic expert system.

Module-V: **(6 Hours)**

Reinforcement Learning: Introduction, Elements of Reinforcement Learning, Model-Based Learning (Value Iteration and Policy Iteration), Nondeterministic Rewards and Actions, Temporal Difference Learning, Relationship to Dynamic Programming

Course Outcome:

1. Ability to comprehend AI & ML to analyze and map real world activities to digital world
2. To explain supervised (classification, regression, prediction) and unsupervised (clustering, feature reduction) problems
3. Implement classification, regression and clustering algorithms.
4. Performance analysis of various classification, regression and clustering algorithms.

Suggested Books and Materials:

1. Artificial Intelligence – Knight & Rich, McGraw Hill, 3rd Edition.
2. Principles of Artificial Intelligence – N. J. Nilson, 2nd Edition, Narosa Publishing.
3. Artificial Intelligence A Modern Approach – Russel & Norvig, 2nd Edition, Pearson.
4. Duda, R.O., Hart, P.E., and Stork, D.G. *Pattern Classification*. Wiley-Interscience. 2nd Edition. 2001
5. Machine LearningFirst Edition, Tom Mitchell. McGraw- Hill, 1997.
6. Introduction to Machine Learning Second Edition, EthemAlpaydin, PHI, 2010

Course Name	Artificial Intelligence
Course Link	https://onlinecourses.nptel.ac.in/noc18_cs40/preview
Course Instructor	Prof. Sudeshna Sarkar**,** Indian Institute of Technology Kharagpur.

Course Name	Artificial Intelligence
Course Link	https://onlinecourses.nptel.ac.in/noc18_cs26/preview
Course Instructor	Prof. BalaramanRavindran, Indian Institute of Technology Madras

20MC402	Enterprise Web Computing with JAVA EWCJ (3-0-0)	3 Credits

Course Objective:

1. Develop dynamic web pages using HTML, CSS and Java Script.
2. Develop applications using JDBC.
3. Develop a small web site using Servlets and ,JSP and database.
4. Understanding the requirement of various frameworks Spring and Hibernate.

Module 1 **(8 Hours)**

Introduction to Web Application: - Introduction and overview of networking concept and Client Server Architectural Model, 3 Tier Architecture, Internet and World Wide Web, Web Browsers, Web Servers, URLs, HTTP, Web applications.

Web Programming: - Basics of HTML Programming: HTML Tags, images, hyperlinks Tables, List, Forms, Frames, CSS, Basic JavaScript Programming: DOM, Loops, function, arrays, form validation, Event handling, XML: Document structure, DTD, XML Schema and Parsing XML documents.

Module II **(8 Hours)**

Basics of JDBC: Architecture of JDBC, Various types of JDBC drivers, Programming with JDBC, creating a database using MySQL, Loading the Driver, Establishing the Connection, Creating Statements (Statement/Prepared Statement/Callable Statement), Executing a SQL Query, manipulating various SQL Queries, Result, Set, Creating Database Connectivity Applications

Module III **(10 Hours)**

Enterprise Java Programming: Java Servlet Technology: Introduction to Servlet, Web Servers and its Containers, Lifecycle of a Servelet, Servelet API, Servlet Packages, Types of servlets, Servlet Config, Servlet Context, sendRedirect(), Request Dispatcher forward(), Session tracking in Servlet, Cookies ,Servlet Filters, Servlet code for mailing using Mail API.

Database Programming: Servlet to DBMS communication using type-4 connection, Servlet communication with other servlets (Servlet Chaining), Servlet communication with JSP or HTML page, Database Access using Servlet.

Module IV **(8 Hours)**

JSP Technology: - Architecture & Anatomy of JSP Page, JSP life cycle, JSP with MVC Architecture, Dynamic webpage Creation, Significance of JSP Engine, Built in objects of JSP, Scripting Elements, Directive tags, Action tags ,Session Tracking, Database

access using JSP page, JSTL, Concept of Ajax. Introduction to Java Server Faces (JSF) Technology.

Module V **(6 Hours)**

Enterprise JavaBeans Technology: EJB Component Architecture, Role of EJB & its life cycle, Types of Beans, Stateless and stateful beans, Overview on Spring: Spring Container, Bean Factory, Application Context , Aspects, Spring MVC, Hibernate.

Course Outcome:

1. Design and implementation of Web pages using HTML, Java Script and CSS.
2. Develop JDBC applications.
3. Implement server-side script using Servest's.
4. Develop dynamic web pages using JSP, develop a web site using JSP, Servlet and Database. Analyze the benefits of various frameworks like Spring, Hibernate.

Suggested Books and Reading Materials:

1. Java Server Programming Java EE6 (J2EE 1.6) Black Book, Kogent Solution Inc.
2. Head First Servlets and JSP 3rd Edition by Bert Bates (Author), Kathy Sierra (Author), Bryan Basham
3. Web Enabled Commercial Application Using HTML, DHTML, JAVA SCRIPT, PERL, CGI ,Ivan Bayross BPB Publication.

Course Name	JDBC Servlets and JSP - Java Web Development Fundamentals
Course Link	https://www.udemy.com/jdbcservletsandjsp/
Course Instructor	Create Java Web Applications from scratch in easy steps by Bharath Thippi Reddy

ELECTIVE-II

20MC403	Internet of Things (IoT) (3-0-0)	3 Credits

Course Objective

1. To learn the basic issues, policy and challenges in the Internet.
2. To get an idea of the application areas where Internet of Things can be applied.
3. To understand the cloud and internet environment and various modes of communications with Internet.
4. To understand the various modes of communications with Internet.

Syllabus

Module1: [10 Hrs]

Introduction & Concepts: Introduction to Internet of Things, Physical Design of IOT, Logical Design of IOT, IOT Enabling Technologies, IOT Levels. Domain Specific IOTs: Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Life Style, Challenges and Issues.

Module 2: [10 Hrs]

M2M & System Management with NETCONF-YANG: M2M, Difference between IOT and M2M, SDN and NFV for IOT, Software defined Networking, Network Function Virtualization, Need for IOT Systems Management, Simple Network Management Protocol, Limitations of SNMP, Network Operator Requirements, NETCONF, YANG, IOT Systems management with NETCONF-YANG

Module-3: [10 Hrs]

IoT Protocols: Protocol Standardization for IoT and WSN Protocols-SCADA and RFID Protocols-Issues with IoT Standardization Protocols IEEE802.15.4-BACNet Protocol- , Architecture - Network layer – APS Layer – Security.

Module-4: [10 Hrs]

Data Analytics for IoT; Introduction Appache Hadoop, using HadoopMapReduce for Batch Data Analysis, Ethics: Characterizing the IoT,Privacy, Control, Distributing

Control and Crowd Sourcing, Environment, Physical Thing, Electronics, InternetService, Solutions, Internet of Things as Part of Solution, Cautious Optimizing, The Open IoT definition.

Course Outcome:

1. Understand the definition and significance of the Internet of Things
2. Discuss the architecture, operation, and business benefits of an IoT solution
3. Examine the potential business opportunities that IoT can uncover
4. Explore the relationship between IoT, cloud computing, and big data

Text Book:

1. VijayMadisetti, Arshdeep Bahga," Internet of ThingsA Hands-On- Approach",2014, ISBN:978 0996025515

2. Honbo Zhou, "The Internet of Things in the Cloud:A Middleware Perspective" -- CRC Press-2012.

3. Arshdeep Bahga, Vijay Madisetti, "Internet of Things (A Hands-On-Approach)", VPT, 2014.

Suggested Book:

1. Atzori, L., Iera, A., & Morabito, G. (2010). The internet of things: A survey. *Computer networks*, *54*(15), 2787-2805.
2. Hersent, O., Boswarthick, D., & Elloumi, O. (2011). *The internet of things: Key applications and protocols*. John Wiley & Sons.
3. Tan, L., & Wang, N. (2010, August). Future internet: The internet of things. In *2010 3rd international conference on advanced computer theory and engineering (ICACTE)* (Vol. 5, pp. V5-376). IEEE.
4. Uckelmann, D., Harrison, M., & Michahelles, F. (Eds.). (2011). *Architecting the internet of things*. Springer Science & Business Media.

Course Name	INTRODUCTION TO INTERNET OF THINGS
Course Link	https://nptel.ac.in/courses/106/105/106105166/
Course Instructor	PROF. SUDIP MISRA Department of Computer Science and Engineering, IIT Kharagpur

ELECTIVE-II

20MC403	Distributed System (3-0-0)	3 Credits

Course Objective:

1. Use the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.
2. Discuss the design and testing of a large software system, and to be able to communicate that design to others

Module-I

Distributed systems: Definition, goals, types of Distributed Systems, Architectures, Key characteristics, Design issues, naming, communication, software structure, workload allocation, consistency maintenance; User requirement, functionality, Quality of service, re configurability

Module-II

Inter-process communication, building blocks, client server communication; CORBA's Common Data Representation (CDR); Java object serialization; Extensible markup language (XML); Remote object references; Inter-process communication in UNIX; Remote procedure calling; Design issues, interface definition language exception handling; Implementation -interface processing, communication handling; Binding, Case-study: sun RPC Vs. Java RMI

Module-III

Distributed Operating systems: kernel, processes and threads, Naming and protection - Communication and Invocation, virtual memory, Distributed file services -design issues, interfaces, implementation techniques, Case study sun NFS, Name services: Name spaces; Name resolution, Domain Name System, SNS and DNS, Peer-to-Peer Systems. Coordination and Agreement: Time and Global States, Time and co-ordination, synchronizing physical clocks-logical time and logical clocks, Distributed co-ordination, distributed mutual exclusion, elections, Replication, basic architectural model, consistency and request ordering.

Module-IV

Distributed Transactions, Recovery and fault tolerances: Transaction recovery, logging -shadow versions, fault model for transaction; Fault tolerance: characteristics; Hierarchical and group masking of faults; Security, authentication and key distribution, logic of authentication, digital signatures; Web Services: SOAP, XML, CORBA,

Distributed object-based systems, Distributed file systems, Distributed web-based systems, Distributed co-ordination-based systems.

Course Outcome:

1. Understand the concepts and issues related to distributed systems.
2. Design and develop the programs for distributed environment.
3. Manage performance, reliability and other issues while designing in distributed environment.

Text books:

1. George Coulouris, Jean Dollimore and Tim Kindberg, "Distributed Systems: Concepts and Design", Fourth Edition, 2006, Pearson Education, Inc. New Delhi.

2. Andrew S. Tanenbaum, Maarten van Steen, "Distributed Systems: Principles and Paradigms", 2nd Edition, 2007, PHI Learning Pvt. Ltd., New Delhi.

3. HagitAttiya, Jennifer Welch, "Distributed Computing: Fundamentals, Simulations, and Advanced Topics", 2nd Edition, 2005, Wiley India Pvt. Ltd., New Delhi.

4. Mordechai Ben-Ari, "Principles of Concurrent and Distributed Programming", 2nd Edition, 2006, Pearson Education, Inc. New Delhi.

5. Mei-Ling Liu, "Distributed Computing: Principles and Applications", 2004, Pearson Education, Inc. New Delhi.

Course Name	Distributed System
Course Link	https://nptel.ac.in/courses/106/106/106106168/
Course Instructor	Prof. Rajiv Mishra, IIT, Patna

ELECTIVE-II

20MC403	OBJECT ORIENTED ANALYSIS AND DESIGN WITH UML (3-0-0)	3 Credits

Course Objective:

1. Understanding of the importance of modeling in the software development life cycle.
2. The UML notation and symbols.
3. The object-oriented approach to analyzing and designing systems and software solutions.
4. How to Employ the UML notation to create effective and efficient system designs.

Module-I

Introduction: Object orientation & Object oriented development, Modeling Concepts: Modeling as a design technique, Class Modeling, advanced class modeling, State Modeling, advanced State Modeling, Interaction Modeling, advanced Interaction Modeling. Collaboration Diagrams: Terms, Concepts, depicting a message, polymorphism in collaboration diagrams

Module-II

Analysis and Design: Process overview, system Conception, Domain Analysis, System Design, Class design.

Module-III

Implementation: Implementation Modeling, Object Oriented (OO) Languages, Databases, Programming Style.

Module-IV

Management of Object-Oriented Software projects, Object oriented analysis, domain analysis and generic components of object-oriented analysis model, object behavior model. The intent of object-oriented metrics, the distinguishing characteristics and metrics for the object-oriented design model, class oriented metrics, operation oriented metrics, metrics for object oriented testing, metrics for object-oriented projects.

Course Outcome:

1. Explain OOAD concepts and various UML diagrams
2. Select an appropriate design pattern
3. Illustrate about domain models and conceptual classes
4. Compare and contrast various testing techniques
5. Construct projects using UML diagrams

Text Books:

1. Michael R. Blaha and James R Rambaugh, "Object-Oriented Modeling and Design with UML", Second Edition, 2005, Pearson Education, Inc. New Delhi. Chapters: 1 to 8, 10, 11, 12, 14, 15, 17, 18, 19, 20.
2. 2. Mark Priestley, "Practical Object-Oriented Design with UML", Second Edition, 2006, McGraw-Hill Education, India. New Delhi.
3. Grady Booch, "Object-Oriented Analysis and Design with Applications", Third Edition, 2007, Pearson Education, Inc. New Delhi.
4. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Third Edition, 2005, Pearson Education, Inc. New Delhi.
5. Mike O'Docherty, "Object Oriented Analysis and Design: Understanding System Development with UML 2.0", 2005, Wiley India Pvt. Ltd., New Delhi.
6. John W. Satzinger, Robert B. Jackson, Stephen D. Burd, "Object-Oriented Analysis and Design with the Unified Process", 2006, CENGAGE Learning India Pvt. Ltd., New Delhi.
7. James Rumbaugh, Grady Booch, Ivar Jacobson, "The Unified Modeling Language

Course Name	OBJECT ORIENTED ANALYSIS AND DESIGN
Course Link	https://nptel.ac.in/courses/106/105/106105153/
Course Instructor	Prof. Partha Pratim Das and Others Dept. of Computer Science and EngineeringIIT Kharagpur

ELECTIVE-II

20MC403	Big Data Analysis (3-0-0)	3 Credits

Course Objective :

1. Understand the Big Data Platform and its Use cases
2. Real- time Analytics Platform (RTAP) and IBM Info sphere
3. Provide HDFS Concepts and Interfacing with HDFS
4. Understand Map Reduce Jobs
5. Provide hands on Hodoop Eco System
6. Apply analytics on Structured, Unstructured Data.

Syllabus

MODULE-I **[8 Hrs]**

Introduction: Big Data Overview, BI Versus Data Science, Current Analytical Architecture, Drivers of Big Data. Data Analytics Lifecycle - Overview, Phases - Discovery, Data Preparation and Model planning, Model building, Communicate Results and Operationalize.
Industry examples of Big Data

MODULE -II **[12 Hrs]**

Big Data Technology: Hadoop's parallel world,Data Discovery, Cloud and Big data, Predictive analytics, crowd sourcing analytics, Inter and Trans firewall analytics.
Information management: Big data foundation, Big data computing platforms, Big data computation, more on Big data storage, Big data computational limitaitons.

MODULE -III **[10 Hrs]**

Estimating moments, Counting oneness in a window, Decaying window - Real- time Analytics Platform(RTAP) applications, IBM Info sphere , Big data at rest , Info sphere streams ,Data stage , Statistical analysis , Intelligent scheduler , Info sphere Streams, Predictive Analytics , Supervised , Unsupervised learning , Neural networks, Mining Frequent item sets , Market based model
Unsupervised Learning and Random forests: Association rules, Cluster analysis, Principal Components, Random forests and analysis.

MODULE -IV **[18 Hrs]**

Apriori Algorithm , Handling large data sets in Main memory , Limited Pass algorithm , Counting frequent item sets in a stream , Clustering Techniques , Hierarchical –K-Means, Clustering high dimensional data Visualizations, Visual data analysis techniques, interaction techniques, Systems and applications IBM for Big Data , Map Reduce Framework, Hadoop , Hive Sharding ,No SQL Databases , Hadoop Distributed file

systems , Hbase, Impala , Analyzing big data with twitter , Big data for E-Commerce , Big data for blogs.

Course Outcome:

1. Identify Big Data and its Business Implications.
2. List the components of Hadoop and Hadoop Eco-System
3. Access and Process Data on Distributed File System
4. understand Data stage , Statistical analysis , Intelligent scheduler , Info sphere Streams
5. Develop Big Data Solutions using Hadoop Eco System
6. Analyze Infosphere BigInsights Big Data Recommendations.
7. Apply Machine Learning Techniques using R

Recommended Books:

1. Data Science and Big data Analytics - EMC Education Services , 2015- WILEY

2. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, Ambiga Dhiraj, Wiely CIO Series, 2013

3. Big Data Analytics - Pyne , Rao and Rao, Springer 4: 2. Arvind Sathi, “Big Data Analytics: Disruptive Technologies for Changing the Game”, 1st Edition, IBM Corporation, 2012.

4. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Course Name	BIG DATA COMPUTING
Course Link	https://nptel.ac.in/courses/106/104/106104189/
Course Instructor	PROF. RAJIV MISRA, Dept. of Computer Science and Engineering, IIT Patna

ELECTIVE-II

20MC403	Computer Network Security (3-0-0)	3 Credits

Course Objective :

1. To be able to secure a message over insecure channel by various means.
2. To learn about how to maintain the Confidentiality, Integrity and Availability of a data.
3. To understand various protocols for network security to protect against the threats in the networks.

MODULE-I **[10 Hrs]**

Introduction to Security: What is security? Why we need Security? Security concerns, Security Goals: Confidentiality, Integrity, Availability, Authenticity and Accountability, Computer security challenges, Security Breach Impact levels: Low, Moderate and High, Security threats/attacks: passive and active, Security Policy, Security issues, Brief History of Malware, Types of Malware, Network Security Audit, The Orange Book, Legal Issues.

TCP/IP Security Attacks: TCP Segment Format, TCP Connection Setup, TCP Disconnection, IP Address Spoofing, Covert Channel, IP Fragment Attacks, TCP Flags, Syn Flood, Ping of Death, Smurf, Fin, UDP Flood Attack, Connection Hijacking, ARP Spoofing, DNS Spoofing, E-Mail Spoofing, Web Spoofing.

MODULE-II **[10 Hrs]**

Introduction to Cryptography, Symmetric-Key Cryptography: Traditional Ciphers, Simple Modern Ciphers, Modern Round Ciphers, Mode of Operations. Asymmetric-key Cryptography: RSA and Diffie-Hellman.

Network Security: Security Services, Message Confidentiality, Message Integrity, Message Authentication: MAC and HMAC, Digital Signature, Key Management: Symmetric-key Distribution: KDC, Session Keys, Kerberos, Public-key Distribution: Certification Authority, X.509, PKI.

MODULE-III **[10 Hrs]**

Authentication, Authentication methods, Passwords, Challenge-Response, Biometrics, something you have, Two-factor authentication., Single Sign-On and Web Cookies.

Authorization, A brief history of authorization, Access control matrix, Compartments, Covert Channel, Inference Control, CAPTCHA, Firewalls and Proxies, Defense in depth, Computer Networks security zones, Concept of Demilitarized Zones (DMZ) in

designing Corporate Networks, Analysis of Network Infrastructure, DMZ: Mail server, WWW Server, DNS Server. Network flooding, Anticipating attacks, IDS.

MODULE-IV **[10 Hrs]**

Simple Security Protocols, Authentication Protocols: authentication using symmetric keys, authentication using public keys, session keys, perfect forward secrecy, mutual authentication, session keys, and PFS, Timestamps, Authentication and TCP, Zero knowledge proofs.

SSH, SSL/TSL: SSL and Man-in-the-Middle, SSL connections, SSL Versus IPSec, , IPSec: IKE Phase I: Digital Signature, Symmetric Key, Public Key Encryption, IPSec Cookies, IKE Phase II, IPSec and IP Datagrams, Transport and Tunnel Modes, ESP and AH, Application Layer Security: Pretty Good Privacy (PGP).

Course Outcome:

1. Describe network security services and mechanisms.
2. Symmetrical and Asymmetrical cryptography.
3. Data integrity, Authentication, Digital Signatures.
4. Various network security applications, IPSec, Firewall, IDS, Web security, Email security, and Malicious software etc.

Textbooks:

- Mark Stamp, Information Security: Principles and Practices, John Wiley & Sons, Hoboken, NJ, 2011. Chapters 1, 7, 8, 9, 10, 11, 13
- Behrouza Forouzan, Data Communications and Networking, McGraw-Hill, 2006. Chapters 30, 31, 32.
- Matt Bishop, Introduction to Computer Security, Addison-Wesley, 2005. Chapters 9, 10.4.2, 11, 22, 23.
- Gert De Laet and Gert Schauwere, Network Security Fundamentals, Cisco Press, Indiana, 2004. Chapters 1, 2, 9. 10.

Reference books:

Richard Bejtlich, The Tao of Network Security Monitoring: Beyond Intrusion Detection, Addison-Wesley. Use this book for Practical.

ELECTIVE-II

20MC403	Software Evaluation (3-0-0)	3 Credits

Course Objective :

1. Understanding of Classification of Software Maintenance and Maintenance Models
2. The Reengineering Concepts
3. Impact Analysis, Impact Analysis Process and Re-factoring
4. Activities in a Re-factoring

MODULE I

Introduction to Evolution and Maintenance, Classification of Software Maintenance: Intention-based, Activity-based, and Evidence-based. Categories of Maintenance Concepts: Product, Types, Organization Processes, Peopleware. Evolution of Software Systems: SPE Taxonomy, Laws of S/W Evolution, Emperical Studies, Evolution of FOSS Systems, Maintenance of COTS-based Systems.

Maintenance Models: Reuse-Oriented Model, Staged-Model for Closed Source Software(CSS) and Open Source Software (OSS), and Change Mini-Cycle Model,

IEEE? EIA and ISO/IEC Maintenance Process, Software Configuration Management.

MODULE II

Reengineering Concepts, A General Model of Software Reengineering, Reengineering Process, Code Reverse Engineering, Techniques used for Reverse Engineering, De-compilation Versus Reverse Engineering, Data Reverse Engineering, Reverse Engineering Tools.

Legacy Information Systems, Wrapping, Migration, Migration Planning, Migration Methods: Cold Turkey, Database First, Database Last, Composite Database, Chicken Little, Butterfly, Iterative.

MODULE III

Impact Analysis, Impact Analysis Process: Identifying the SIS, Analysis of Traceability Graph, Identifying the Candidate Impact Set, Dependency-Based Impact Analysis: Call Graph, Program Dependency Graph, Ripple Effect, Computing Ripple Effect, Change Propagation Model: Recall and Precision of Change Propagation Heuristics, Heuristics for Change Propagation, Empirical Studies.

MODULE IV

Re-factoring, Activities in a Re-factoring Process, Formalisms for Re-factoring: Assertions, Graph Transformation, Software Metrics, Examples of Re-factorings,

Initial Work on Software Restructuring, Factors Influencing Software Structure, Classification of Restructuring Approaches, Restructuring Techniques.

Reuse: Benefits of Reuse, Reuse Models, Factors Influencing Reuse, Success Factors of Reuse. Reuse Capability, Economic Models of Software Reuse: Cost Model of Gaffney

and Durek, Cost Model of Gaffney and Cruickshank, Business Model of Poulin and Caruso.

Domain Engineering, Application Engineering, Domain Engineering Approaches.

MODULE V

Program Comprehension, Goal of Code Cognition, Knowledge, Mental Model, Understanding Code, Cognition Models for Program Understanding: Letovsky Model, Shneiderman and Mayer Model, Brooks Model, Soloway, Adelson, and Ehrlich Model, Pennington Model, Integrated Meta-model, Protocol Analysis, Visualization for Comprehension.

Course Outcome:

1. To understand Classification of Software Maintenance
2. To understand Maintenance Models
3. To understand Reengineering Concepts
4. To understand Impact Analysis, Impact Analysis Process
5. To understand Re-factoring, Activities in a Re-factoring

Text Book:

1. Software Evolution and Maintenance: A Practitioner's Approach, Priyadarshi (Piyu) Tripathy, and Kshirasagar (Sagar) Naik, Wiley, Hoboken, NJ, 2015.

Reference Book:

1. Software Maintenance Concepts and Practice, Grubb P. and Takang A, 2e, World Scientific, 2003.

MISSION

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