Design and Analysis of Algorithms

ECSL 202B **3 – 1 – 0 = 4**

Introduction: Definition of algorithm, algorithm specification, performance analysis: Time and space analysis, Asymptotic, recurrence relations.

Design of Efficient algorithms: Graphs, trees, recursion, divide and conquer, balancing, dynamic programming.

Sorting: Merge sort, Heaps and maintaining the heap properties, building a heap, Heap sort, Quicksort: algorithm, performance and anlaysis, Sorting without comparison: Radix sort, counting sort, bucket sort.

Some data structures: Hash tables, hash functions, Open addressing, Binary search trees-insertion and deletion, Balanced trees: AVL trees, m-way trees, B Trees, 2-3 Trees, Binomial heaps: Binomial trees and operations on binomial heaps.

Advanced design and analysis Techniques: Dynamic programming: Definition, Matrix-chain multiplication, Optimal binary search trees, Longest common subsequence, 0-1 knapsack problem.

Greedy algorithms: Definition, Fractional knapsack problem, Huffman coding, Task-scheduling problem.

Divide and conquer algorithm: Definition, Strassen's matrix multiplication, finding minimum and maximum from an array.

Backtracking: Definition, n-queens problem, sum of subset problem.

Graph algorithm: Elementary graph algorithms, Breadth-first and Depth-first search, Minimum spanning trees: Prim's and Krushkal's algorithm, Single source shortest path problem, Bellman-Ford algorithm, Floyd-Warshall algorithm, Johnson's algorithm.Integer and Polynomial arithmetic:Polynomial addition and multiplication.

Suggested Readings:

- Introduction to Algorithm, TH Corman, Charles E, PHI
- 2. The design and anal. Of Comp. Algorithms Aho, Hopcroft, Ullman Addition Wesley
- Computer Algorithms, Galgotia., Horowitz, Sahni and Rajsekaran
- Data Structure, Tata McGraw Hill , Lipschuitz
- 5. Fundamentals of Data Structures, Galgotia , Horoqwitz, Sahni .

Operating System

ECSL 203B **3 – 0 – 0 = 3**

Introduction to OS: Processor management, memory management, file system management, system calls.

Memory management: Single user contiguous: protection; fixed partition multiprogramming; protection, fragmentation, relocation; variable partition multiprogramming: compaction, storage placement strategies; multiprogramming with storage swapping; paging: segmentation; paging and segmentation together; virtual memory: page replacement and strategies,

locality, working sets, page fault frequency, demand paging, optimization technique.

Processor management: Scheduling levels, quantities to be optimized , preEMEPtive/non preEMEPtive, interrupting clock, FIFO , shortest job first, shortest remaining job first, round robin, priority, multilevel queues, multilevel feedback queues.

File systems: directory organization, functions, data hierarchy, blocking and buffering, file organization, free space management, allocation techniques: contiguous, non contiguous; sector oriented linked; block: block chaining , index block chaining, block oriented file mapping;

Device management: types: block, character; PIO, DMA, I/O channels, virtual devices.
Dead locks: Resource concepts, necessary conditions, resource allocation graph, deadlock prevention: three strategies of Havender, deadlock avoidance: Bankers algorithm, deadlock detection: reduction of resource allocation graph, deadlock recovery.

Concurrent processes: Mutual exclusion and Bernstein's conditions, Fork/Join construct, PARBEGIN/PAREND construct; semaphores: use of semaphores to complement PARBEGIN/PAREND; critical section problem ; 2 process critical section problem and solution, both H/W and S/W; monitors; message passing ; case studies: dining philosophers problem, reader writer problem and disk head scheduler problem.

Disk scheduling: operations of disks, quantities to be optimized, seek optimization : FCFS, SSTF, SCAN, C-SCAN, M-STEP SCAN, Eschenbach; rotation optimization, system consideration, disk caching and other optimizations.

Suggested Readings:
Operating system concepts : Silberschatz, Addison Wesley Longman
Modern Operating Systems : Tanenbaum, PH(I)
Operating systems : H.M.Deitel, Addison Wesley Longman
Operating systems : Madnick and Donovan, McGraw-Hill I.E.

Operating System Lab

ECSP 202B **0 – 0 – 2 = 1**

Students will be required to do at least 10 experiments based on the following topics:-

Two on memory management,
Two on virtual memory,
Two on CPU scheduling,
Two case studies of existing OS,
Two on file systems.

Computer Organization & Architecture

ECSL 204B **3 – 1 – 0 = 4**

Introduction: Overview of Digital Fundamentals

Register Transfer and Microoperation: Register Transfer Language, Register Transfer, Bus and Memory Transfer, Arithmetic Microoperations, Logic Microoperations, Shift Microoperations.

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycle, Memory Reference Instructions, Input-Output and Interrupts, Design of Basic Computer, Design of Accumulator Logic.

Microprogrammed Control Unit: Control Memory, Address Sequencing.

Central Processing Unit: Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes.

Computer Arithmetic: Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating Point Arithmetic Operation, Decimal Arithmetic Unit, Decimal Arithmetic Operations.

Input–Output Organization: Peripheral devices, Input – Output interface, Asynchronous Data Transfer, Modes of Data Transfer, Priority Interrupt, Direct Memory Access, Input – Output Processor.

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

Multiple Process Organization: Flynn's classification of parallel processing systems, pipelining concepts.

Suggested Readings:

- Computer System and Architecture, Mano, M , PHI
- Computer Organization & Design, Pal Chaudhuri, P., PHI
- Digital Computer Electronics: An Introduction to Microcomputers, Malvino
- Digital Principles and Applications, 4/e ,Malvino , M G Hill
- Computer Architecture and Organization, Hayes. J.P , M G Hill
- Computer Organization & Architecture, Stallings, W , PHI

Software Engineering

ECSL 205B **3 – 0 – 0 = 3**

Introduction: Aim, Role in system Design, Relationship to other areas/disciplines,S/w:its nature&Qualities, Programs vs software products, classification of s/w products, etc.

Software development Life cycle: Different Models & Assessment, Water fall model, Iterative enhancement model, prototype model, spiral model.

Software Project Management: Planning, Scheduling, Organization & Structure, Staffing, Risk Management, Configuration Management, etc. Requirement Analysis & Specification- SRS document- need and scope.

Software Testing & Maintenance: Software Testing, verification and validation. Software reliability & Quality Assurance(ISO 9000), Software maintenance. CASE tools

Suggested Readings:

1. Software Engg: A practitioner's Approach Pressman,R.S McGraw Hill
2. Fundamentals of S/W Engg. , Ghezzi, C ,PHI
3. Managing the Software Process ,W S Humphrey Addison–Wesley
4. Ed. Encyclopaedia of Software Engg., Vols 1&2 , J J Marciniak,John wiley
5. Software Engg.,5/e, Sommerville Ian Addison Wesley.
6. Software Engg., Manmdrioli, Dino
7. Software Engg:A programming Approach,3/e, Bell,Douglas
8. An intregrated Approach to Software Engg. ,Jalote, P ,Narosa Pub House
9. Fundamentals of Software Engg., Mall, Rajib, PHI

Object Oriented Programming

ECSL 206B **3 – 1 – 0 = 4**

Principles of Object Oriented Programming

The Traditional Approach, Shortcoming of procedure oriented languages, Basic concepts of Object Oriented Programming, Benefits of OOP, Object Oriented Languages

Overview of Programming Basics

Input/Output using cin/cout, processor directives, basic and user defined data types, operators, loops, decision making, control statements, functions, pointers to functions

Classes

Definition, Class objects, Class member functions, Static Class Members, Class Scope, Nested Classes, Local Classes, Composite class, Constructor, Destructor, Friends, *this* Pointer

Operator Overloading

Overloading unary and binary operators, Special operators : Operator [ ], ( ), →, ++ and --, << and >>

Inheritance and Polymorphism

Class hierarchy : Definition, Identifying the members of the hierarchy, Base class member access, Base and derived class construction, Member wise initialization and assignment, virtual functions, multiple inheritance, class scope under inheritance, virtual classes.

Templates

Class Templates, Function Templates

Exception Handling

Throwing, The try…..catch block, Exception specifications

Reference:

Object Oriented Programming with C++ ANSI/ISO Standards, R. Subburaj

Object Oriented Programming Lab

ECSP 206B **0 – 0 –2 = 1**

---

1. Simple C++ Program.
2. Programs on Function overloading.
3. Programs on Operator overloading.
4. Programs on Inheritance.
5. Virtual functions and Dynamic binding.
6. Templates.

7. File Handling.
8. Exception handling.

Engineering Computational Methods Lab

ECSP 207B **0 – 0 – 2 = 1**

Practicals in C implementing the various numerical techniques learned in the theory class

Discrete Structures

SPML 202B **3 – 0 – 0 = 3**

Modern Algebra: Sets. Binary relation , equivalence relation. Functions, Injective, Surjective & Bijective mappings. Partial order relations, PO-set, Lattice & Boolean algebra. Algebraic structures, Semi group, Monoid, Group, Cyclic group, Subgroup, Normal subgroup, Quotient group, Homomorphism of groups. Ring, Integral domain, Field. Vector space , Linear dependence & independence . Basis & Dimension. Combinatories, Recurrence relations & Generating functions.

Mathematical Logic: Statement Calculus- sentential connectives, Truth tables, Logical equivalence, Deduction theorem. Predicate Calculus- Symbolizing everyday language, validity and consequence. First order theories.

Metric space: Definition & examples of Metric space. Open & Closed spheres. Open & Closed sets.

Suggested Readings:

1. Set Theory and Logic , R.R Stoll.,S. Chand.& Co.
2. Mathematical Logic, Mendelson, D. Van Nostrand Co.
3. Topology and Modern Analysis, Simmons, Mc Graw Hill
4. Modern Algebra, Herstein, New age International

Computational Methods

SPML 205B **3 – 0 – 0 = 3**

SECTION - A

Differences: Error in interpolation, Detection of error by use of difference tables, Differences of a Polyomial, Newton's formula for Forward and Backward interpolation, Gauss Central difference. Interpolation formula, Striling's formula, Bessesl's formula, Interpolation with unequal intervals; Lagrange's formula, Divided differences and their properties, Newton's general Interpolation formula, Inverse interpolation.

SECTION - B

Errors in Numerical Calculations, Number and their accuracy, Errors and their analysis errors in a series approximation. Numerical solutions of algebraic and transcedental equations: Bisection Method, Iternative Method, Method of false-position, Newton-Raphson method, Secant method, curve fitting and

approximation; fitting of a straight line. Approximation of functions, Chebyshex polynimals. Taylor's series approximation. Solution of linear systems of equations: Direct method, Elimination method. Gauss-seidel method, Jacobi method.

SECTION - C

Numerical Differentiation: Maximum and minimum value of a tabulted function, Numerical Integration: Trapezoidal Rule. Simpon's 1/3 and 3/8 Rule. Newton-cotes integration formula. Gaussian quardrature formula. Numerical evaluation of singular integrate. Numerical solution of ordinary differential equations: Solution by Taylor's series. Euler's method, Picard's method. Runge Kutta method. Predictor Corrector Method: Miline's method and Adams-Moulton's method.

Note: (Students should be asked to develop algorithms and Computer programs in fortran for these methods.)

Reference Books:

1. Rajaraman V. :Computer Oriented Numerical Methods, Prentice Hall of
2. Foroberg:Introduction of Numerical Analysis. Addison Wesely.
3. B.S.Grewall: Higher engineering Mathematics.
4. Conte, C.D. & Boor, C.D.:Elementary Numerical Analysis An algorithmic approach, Mc-Graw Hill.
5. Kendall, N.A. & Atkinson, K.E. ::An Introduction to Numerical Analysis, John Willey & Sons
6. Krishnamurthy V.: Computer based Numerical Algorithms, East West
7. Shastri S.S. :Introductory methods of Numerical Analysis
8. Jain M.K. et. al.: Numerical Methods.