Semester 3 (2nd year 1st Semester)

Course Name: Combinatorial Optimization
Code: CSE 301
Credit: 2 Credit Theory and 1 Credit Lab

Course Outline: Introduction - Algorithms, Analyzing & Designing Algorithms, Correctness of Algorithms; Greedy Algorithms - Introduction to Greedy Algorithms, Greedy Choice Property, Greedy vs. Dynamic Programming, Fractional Knapsack Problem, Activity Selection Problem, Huffman Encoding, Task Scheduling Problem, Coin Changing Problem, Kruskal's and Prim's Minimum Spanning Tree Algorithms; Divide and Conquer Algorithms - Introduction to Divide and Conquer Design Technique, Quick Sort, Merge Sort, Proof of Correctness, and Run Time Analysis; Dynamic Programming - Introduction to Dynamic Programming Technique, Principle of Optimality, Optimal Substructure Property, Assembly Line Scheduling, Matrix Chain Multiplication, LCS, Viterbi Algorithm, Bitonic Euclidean Traveling Salesperson Problem and Runtime Analysis; Graph Searching and Shortest Path Problems - Breadth First Search, Depth First Search, Flow Networks, Single Source and All Pair Shortest Path Algorithms; Linear Programming -Overview of Linear Programming, Formulating Problem as Linear Programs, Simplex Algorithm and Integer Linear Programming; Selected Topics - Computational Geometry, Number Theoretic and String Matching Algorithms; NP Completeness and Approximation Algorithms - NP Completeness, Polynomial Time Verification, NP Completeness and Reducibility, NP Complete Problems and Approximation Algorithms.

References:

1. Thomas Corman, *Introduction to Algorithms*, Stein Pub MIT Press, 3rd Ed.
2. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, *The Design and Analysis of Computer Algorithms*, Addison Wesley Series, 1974 Ed.

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Course Title: Numerical Analysis for Engineers
Code: MATH 304
Credit: 2 Credit Theory and 1 Credit Lab

Outline: Introductory concepts and calculus review, 'C' programming, the sources and propagation of errors, root finding for nonlinear equations, solution of system of linear equations, interpolation and approximation theory, numerical integration and differentiation.

References:

1. Numerical Methods, E Balagurusamy, Tata McGraw-Hill Publishing Company, 2002

Course Title: Software Project Lab I
Code: SE 305
Credit: 3 Credit Lab

Course Outline: Each of the students should complete the software project separately. They will be marked based on their individual software. Student will be encouraged to develop software which requires significant "problem solving" effort. The project should be sufficiently large and the size of the project will mostly depend on "problem solving" effort. Besides, students must showcase the skills they have acquired from their so far completed courses.

Course Title: Object Oriented Concepts II
Code: SE 306
Credit: 2 Credit Theory and 1 Credit Lab

Course Outline: Object Oriented Concepts - Review of Object Oriented Concept - Object Data, Object Behaviors, Class, Attributes, Methods, Encapsulation and Data Hiding: Interfaces and Implementations, Inheritance: Super classes and Sub classes, Abstraction and Is-A relationship, Polymorphism, Compositions: Abstractions and Has-A Relationship; Mastering Composition and Building Objects – Representing Composition with UML, Composition Relationships, Building in Phases, Types of Composition: Aggregation and Associations, Avoiding Dependencies and Cardinality; Details of Creating Object Models with UML – Class Diagram, Attributes and Methods, Access Designations, Inheritance, Interfaces, Composition: Aggregations and Associations, and Cardinality; Objects and Portable Data - Portable Data, The Extensible Markup Language (XML), XML Versus HTML, XML and Object-Oriented Languages, Validating the Document with the Document Type Definition (DTD), Integrating the DTD into the XML Document, and Using Cascading Style Sheets; Persistence objects – Basics of Persistence, Saving to a Flat File, Using XML in the Serialization Process and Writing to a Relational Database; Objects and the Internet – Object-Based Scripting Languages, Objects in a Web Page and Distributed Objects and the Enterprise; Objects and Client/Server Applications – Client/Server Approaches, Proprietary Approaches and Nonproprietary Approaches; Object Oriented Design Principles - Single Responsibility Principle, Open/Close Principle, Liskov Substitution Principal, Interface Segregation Principle and Dependency Inversion Principle; Introduction to Component Based Design, Design Patterns and Code Smells. **Programming lessons** - Object Oriented Programming (OOP) - The students will implement each of the object oriented concepts which are discussed in the class. Java features to support practical OOP –

Generics: Wildcard, Generic class definitions, Generic method definitions, Using generics; Collection Framework: Collection interfaces, List and SortedList, Map and SortedMap, Navigable Map, Set and Sorted Set, Navigable Set, Queue and DeQueue, Stack, hashCode() and equals(), Comparator and Comparable; Reflection: The *Class* Class, reflect package, Fields and Methods, Exception Handling and Reflections and Dynamic Programming; Multi-Threaded Programming: Overview of Thread, Java Thread Model, Creating and Running Thread, Thread Pools, Thread Synchronization, wait and notify, join and sleep and The concurrency API; User Interface: Swing, Components, Container, Events, Layouts and SwingWorker; Serialization: Serializable interface, Writing and Reading an Object, Handling Exceptions, Customized Serialization and Controlling Serialization; Socket Programming: Clients and Servers, Ports, Addresses and Protocols, Communication using I/O, Servers, The ServerSocket Class, The URL lass and URLConnction Class; Java Servlet Programming: Introduction To Servlet, Servlet Life cycle, HttpServlet, HttpRequest, HttpResponse, RequestDispatcher, HttpSession and ServletContext, Servlet Configuration, Cookies, Servlet Filters and Http Headers and MIME types; The Java Beans AOI: Introspector, PropertyDescriptor, EventSetDescriptor and MethodDescriptor.

References:

1. The Object Oriented Thought Process, Matt Weisfeld, Addison-Wesley
2. Java How to Program, Paul Deitel and Harvey Deitel, McGraw Hill
3. Java: The Complete Reference, Herbert Schildt, McGraw Hill
4. Head First Java by Kathy Sierra and Bert Bates, O Reilly

Course Title: Computer Networking
Code: CSE 311
Credit: 2 Credit Theory and 1 Credit Lab

Course Outline: Introduction: Overview of the Internet, Overview of Networking Protocols, Network Edge, Network Core, Protocol Layers / Service Model, General Networking Example; Application Layer: Principles of Networking Applications, Web and HTTP, FTP, E-mail, DNS; Transport Layer: Transport Layer Services, Multiplexing and De multiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transport, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control; Network Layer: Datagram Networks, Inside a Router, Details of the Internet Protocol (IP), IP Sub netting, Routing Algorithms (Link State, Distance Vector), Routing in the Internet (Routing Information Protocol (RIP), Open Shortest Path First (OSPF), Border Gateway Protocol (BGP)).

References:

1. Data Communications and Networking, B. A. Forouzan, 5/e

Course Title: Theory of Computing
Code: SE 312
Credit: 3 Credit Theory

Course Outline: Brief Review of mathematical background: Binary relations, digraph, string, languages, proofs, inductive definitions; Finite automata and regular expressions: Deterministic and non-deterministic finite automata, regular expressions and regular sets, Kleene's Theorem; Properties of regular sets: pumping lemma, closure properties, decision algorithms; Context Free grammar and

languages: Context-free grammars, regular grammars; Simplified forms and normal forms: useful symbols, productions, unit productions, chomsky normal form; Pushdown automata: pushdown automaton, equivalence between pushdown automata and context-free languages; Turing machine: introduction to Turing machines.

References:

1. Introduction to Automata Theory, Languages, and Computation by John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education.

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