Semester 3 (2nd year 1st Semester)

Course Code	Course Title	Credit	Theory	Lab
CSE 2101	Algorithm Analysis	2	2	0

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.

Course Code	Course Title	Credit	Theory	Lab
CSE 2102	Algorithm Analysis Lab	1	0	1

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.

Course Code	Course Title	Credit	Theory	Lab
SE 2103	Theory of Computation	2	2	0

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.

Course Code	Course Title	Credit	Theory	Lab
SE 2104	Theory of Computation Lab	1	0	1

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.

Course Code	Course Title	Credit	Theory	Lab
CSE 2105	Computer Networks	2	2	0

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 Code	Course Title	Credit	Theory	Lab
CSE 2106	Computer Networks Lab	1	0	1

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 Code	Course Title	Credit	Theory	Lab
MATH 2107	Numerical Analysis for Engineers	2	2	0

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 Code	Course Title	Credit	Theory	Lab
MATH 2108	Numerical Analysis for Engineers Lab	1	0	1

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 thory, numerical integration and differentiation.

References:

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

Course Code	Course Title	Credit	Theory	Lab
SE 2109	Object Oriented Concepts II	2	2	0

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 Code	Course Title	Credit	Theory	Lab
SE 2110	Object Oriented Concepts II Lab	1	0	1

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 Code	Course Title	Credit	Theory	Lab
SE 2112	Software project Lab I	3	0	3

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.

Semester 4 (2nd year 2nd Semester)

Course Code	Course Title	Credit	Theory	Lab
CSE 2201	Operating Systems and System Programming	2	2	0

Course Outline: Introduction: What is operating system? History of operating system Operating system concepts Operating system structure Processes and Threads Processes Threads Interprocess communication Scheduling Classical IPC problems Memory Management No memory abstraction Virtual memory Page replacement algorithms Design issues for paging systems Implementation issues File Systems Files Directories File system management Input / Ouptut Principles of I/O hardware Principles of I/O software I/O software layers Disks Clocks Thin clients Deadlocks Resources Detection Recovery Avoidance Prevention Virtualization and Cloud

Course Reference Books:

1. Operating System Concepts, 7th edition, by Silberschatz, Galvin, Gagne
2. Modern Operating Systems, 4th edition, Tanenbum, Bos

Course Code	Course Title	Credit	Theory	Lab
CSE 2202	Operating Systems and System Programming Lab	1	0	1

Course Outline: Introduction: What is operating system? History of operating system Operating system concepts Operating system structure Processes and Threads Processes Threads Interprocess communication Scheduling Classical IPC problems Memory Management No memory abstraction Virtual memory Page replacement algorithms Design issues for paging systems Implementation issues File Systems Files Directories File system management Input / Ouptut Principles of I/O hardware Principles of I/O software I/O software layers Disks Clocks Thin clients Deadlocks Resources Detection Recovery Avoidance Prevention Virtualization and Cloud

Course Reference Books:

1. Operating System Concepts, 7th edition, by Silberschatz, Galvin, Gagne
2. Modern Operating Systems, 4th edition, Tanenbum, Bos

Course Code	Course Title	Credit	Theory	Lab
GE 2203	Business Psychology	3	3	0

Course Outline: Fundamentals: Definition of Psychology, Subfields of Psychology, Major Perspectives of Psychology, Psychology in Business; Job Analysis: Job-oriented Approach, Person-oriented Approach, Purposes of Job Analysis, Methods of Job Analysis, Job Evaluation; Assessment Methods for Selection and Placement: Psychological Tests: Ability Test, Personality Test, Intelligence Test, Vocational Interest Test; Training and Development: Training Need Analysis, Training Designs, Training Methods, Evaluation of Training; Theories of Employee Motivation: Need Theories, Reinforcement Theory, Expectancy Theory, Goal Setting Theory; Job Attitude and Emotion: Nature of Job Satisfaction, Assessment of Job Satisfaction, Antecedents of Job Satisfaction, Potential Effects of Job Satisfaction, Organizational Commitment, Emotion at work; Productive and Counterproductive Employee Behavior: Productive Behavior, Job Performance; Counterproductive Behavior, Withdrawal, Aggression, Mistreatment, Sabotage, and Theft; Occupational Health Psychology: Occupational Health and Safety, Work Schedules, Occupational Stress, Work-Family Conflict, Burnout, Hawthorne Studies; Leadership: Approaches to the Understanding of Leadership Trait Approach, Leader Behavior Approach, Contingency Theory, Path-Goal Theory, Leader-Member Exchange (LMX) Theory, Transformational Leadership Theory; Organizational Development and Theory: Organizational Development Employee Acceptance of Change, Management by Objectives, Survey Feedback, Team Building, T-Group; Effectiveness of Organizational Development: Organizational Theories, Bureaucracy, Theory X and Theory Y, Open System Theory, Socio-technical System Theory.

References:

3. Industrial and Organizational Psychology: Research and Practice, Paul E. Spector, 5th Edition

Course Code	Course Title	Credit	Theory	Lab
CSE 2205	Information Security	2	2	0

Course Outline: Overview: Network Security Concepts, Security Attacks, Services and Mechanisms; Classical Encryption techniques: Symmetric Cipher Model, Substitution and Permutation Ciphers, Steganography; Block Ciphers and Data Encryption Standard: Design principles and modes of operation; Public-key cryptography: Introduction to number theory, RSA and Diffie-Hellman; Message Digest: Requirements for cryptographic hash functions,MD5 ,SHA, Message authentication codes, digital signatures; Key Management and Distribution: Symmetric Key Distribution using Symmetric Encryption, Symmetric Key Distribution using asymmetric Encryption, public key distribution, public key certificates, x.509 certificates; Network and Internet Security: Transport Layer Security, Wireless LAN security, e-mail security.

References:

1. Information Security: Principles and Practice by Mark Stamp 2nd Edition Wiley 2011

Course Code	Course Title	Credit	Theory	Lab
CSE 2206	Information Security Lab	1	0	1

Course Outline: Overview: Network Security Concepts, Security Attacks, Services and Mechanisms; Classical Encryption techniques: Symmetric Cipher Model, Substitution and Permutation Ciphers, Steganography; Block Ciphers and Data Encryption Standard: Design principles and modes of operation; Public-key cryptography: Introduction to number theory, RSA and Diffie-Hellman; Message Digest: Requirements for cryptographic hash functions,MD5 ,SHA, Message authentication codes, digital signatures; Key Management and Distribution: Symmetric Key Distribution using Symmetric Encryption, Symmetric Key Distribution using asymmetric Encryption, public key distribution, public key certificates, x.509 certificates; Network and Internet Security: Transport Layer Security, Wireless LAN security, e-mail security.

References:

1. Information Security: Principles and Practice by Mark Stamp 2nd Edition Wiley 2011

Course Code	Course Title	Credit	Theory	Lab
CSE 2207	Database Management System-I	2	2	0

Course Outline: Introduction to Database Systems: Evolution of file processing systems, role of databases in organizations, core components of a database environment; Data Modeling: the Entity-Relationship Diagram and its symbols and constructs; The Relational Model and Normalization: relational model, normalization, transformation of an entity-relationship data diagram into a relational model; SQL - A Standard Navigation Language for Relational Databases; Overview of Object-Oriented Databases: object-oriented data model, implementation of object persistence using relational databases.

References:

1. Database System Concepts by Avi Silberschatz, Henry F. Korth and S. Sudarshan, Sixth Edition

Course Code	Course Title	Credit	Theory	Lab
CSE 2208	Database Management System-I Lab	1	0	1

Course Outline: Introduction to Database Systems: Evolution of file processing systems, role of databases in organizations, core components of a database environment; Data Modeling: the Entity-Relationship Diagram and its symbols and constructs; The Relational Model and Normalization: relational model, normalization, transformation of an entity-relationship data diagram into a relational model; SQL - A Standard Navigation Language for Relational Databases; Overview of Object-Oriented Databases: object-oriented data model, implementation of object persistence using relational databases.

References:

1. Database System Concepts by Avi Silberschatz, Henry F. Korth and S. Sudarshan, Sixth Edition

Course Code	Course Title	Credit	Theory	Lab
SE 2209	Software Requirements Spec. and Analysis	2	2	0

Course Outline: Review of – The Nature of Software, Software Engineering, The Software Process, Software Engineering Practices, Generic Software Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Model and Agile Development. Requirements Engineering, Establishing the ground work, Eliciting Requirements, Negotiating Requirements, Validating Requirements, Requirements Analysis, Scenario-Based Modeling, UML Models, Data Modeling Concept, Class Based Modeling, Requirements Modeling Strategies, Flow-Oriented Model, Behavioral Model, Requirements Modeling for WebApps.

References:

1. R. S. Pressman, Software Engineering. A Practitioner's Approach, 7/e or higher, McGraw Hill
2. Ian Sommerville. Software Engineering, 9th or higher Edition, Addison-Wesley.

Course Code	Course Title	Credit	Theory	Lab
SE 2210	Software Requirements Spec. and Analysis Lab	1	0	1

Lab: One small real life system will be given to all the students for analyzing in the class room. Three real life mid-scale systems will be distributed among groups (created randomly) of 5/6 students to analyze (one project per group). The output of both of the analysis will be specification reports.

Course Code	Course Title	Credit	Theory	Lab
BUS 2211	Business Studies for Engineers	3	3	0

Course Outline: Managers and Entrepreneurs: Management Defined, Role of a Manager, Small-Business Management, The Evolution of Management Thought, Organization, Organization Charts, Contrasting Theories of Organization, Organizational Effectiveness, Organizational Cultures, Change, Conflict, and Negotiation in Organization; The Strategic Management Process, Strategic Implementation and Control, Forecasting. **Accounting Basic:** Forms of Business Organization, Types of Activities performed by Business Organization, Financial statements of Business Organization, The Accounting Equation, The Account and Rules of Debit and Credit, The Journal: Recording of Transaction, Adjusting the Accounts, Closing Entries, and Preparing Financial statements from the Work Sheet. **Analysis and Interpretation of Financial Statement:** Objectives of Financial Statement Analysis, Analysis of a Balance Sheet, Analysis of Statement of Income and Retained Earnings, Ratio Analysis: Liquidity Ratios, Equity or Long Term Solvency Ratio, Profitability Test, Market Test.

References:

1. Stephen P. Robbins and Mary Coulter, *Management*, Prentice Hall, Latest Edition
2. Jerry J. Weygandt, Donald E. Kieso, and Paul D. Kimmel, *Accounting Principles*, Wiley, 8th Ed.