First Year: *Semester II*			
Course No	**Course Title**	**Hours/Week Theory + Lab**	**Credits**
SWE 125	Introduction to Software Engineering	3 + 0	3
SWE 127	Data Structure	3 + 0	3
SWE 128	Data Structure Lab	0 + 4	2
PHY 102W	Basic Physics Lab	0 + 3	1.5
MAT 107W	Linear and Abstract Algebra	3 + 0	3

STA 101W	Basic Statistics and Probability	3 + 0	3
SOC 203W	Sociology for Engineers	3 + 0	3
SWE 150	Project Work-I	0 + 4	2
	Total	**15 + 11 = 27**	**20.5**

SWE 150 PROJECT WORK-I

4 Hours/Week, 2 Credits

Any project based on C language including implementation of Data Structure is acceptable. Gaming project using graphics.h library in C is preferable. Teachers must have to ensure every project is unique. Innovative project idea should get extra weight to prevent imitating old projects.

SWE125 INTRODUCTION TO SOFTWARE ENGINEERING

3 Hours/Week, 3 Credits

Introduction: Overview of Software Industry, Introduction to Software Engineering, Software Development Process and Various Life Cycle Models. **Requirement Analysis:** Communication Techniques, Analysis Principles, Software Prototyping, Requirement Specification. **Group Dynamics:** Working in Teams, Characteristics of Successful Team, Understanding Group Dynamics, Team Roles and Temperament, Democratic Team and Chief Programmer Team Approach. **Introduction to Extreme Programming, Analysis Modeling:** Steps of system analysis, Feasibility study, Economic and technical analysis, System specification, the elements of analysis model, Data modeling, Functional modeling and information flow, Behavioral modeling, Mechanics of structured analysis, Data Dictionary. **Software Design:** Design principles, Design Concepts, effective modular design, design heuristics, Data Design, Architectural Design process, Transformation mapping, Transaction mapping, interface design, human-computer interface design, procedural design. **Software Testing:** Testing fundamentals, test case design, white-box testing, black-box testing, testing GUIs, Unit testing, Integration testing, validation testing, system testing, debugging. **Maintenance:** Major maintenance activities, estimating maintenance cost and productivity. **Technical Metrics for Software:** Software quality, Framework for technical metrics, metrics for analysis and design models, source code, testing and maintenance. **Software Architecture:** Pipe and Filter, Object Oriented, Event Based, Layered System, Data-centered repository, Process Control

Architectures, **Objet Oriented Software Engineering:** O-O concepts, O-O analysis, Domain analysis, O-O analysis process, Object relational model. O-O design: system design process, object design process, O-O programming. **O-O Testing:** Testing strategies, test case design. **Service Oriented Software Engineering:** Introduction to SOA, SOAP, Analysis, design, validation, verification, implementation and maintenance of service oriented software; ESB, Messaging Architecture, Software Tools for SOA. **Software Project Management:** Cost estimation, risk analysis, project scheduling. **Introduction to CASE Tools:** What is CASE, taxonomy of CASE tools, iCASE environment, CASE repository, Example CASE tools. **Intellectual Properties:** Trade Marks, Copy Rights, Trade Secrets, Patents, **Introduction to UML.**

Text:

1. Beginning Software Engineering– Rod Stephens

Reference:

1. Software engineering–Ian Sommerville
2. Software Engineering: An Engineering Approach–Peters

SWE 127 DATA STRUCTURES

3 Hours/Week, 3 Credits

Internal Data Representation: Specification, representation, Asymptotic analysis: Recurrences, Substitution method and manipulation of basic data structures: arrays, records and pointers, linked lists, stacks, queues, recursion, trees, optimal search trees, heaps, disjoint sets.

Recursion: permutation, combination. **Sorting:** merge sort, quick sort (randomized quick sort), distribution sort (counting sort, radix sort, bucket sort), lower bounds for sorting, external sort. **Binary Tree:** Binary tree representation using array and pointers, traversal of Binary Tree (in-order, pre-order and postorder). **Ternary tree, Binary Search Tree:** BST representation, basic operations on BST (creation, insertion, deletion, querying and traversing), application- searching, sets. **Ternary search tree, Binary Index tree, Segment tree, RMQ(Range Minimum Query).**

Searching: Application of Binary Search- finding element in a sorted array, finding nth root of a real number, solving equations. **Heap:** Min-heap, max-heap, Fibonacci-heap, applications-priority queue, heap sort.

SetOperations& Disjoint Set: Union find, path compression. **Huffman Coding**

Graph: Graph representation (adjacency matrix/adjacency list), basic operations on graph (node/edge insertion and deletion), traversing a graph: Review of Breadth first search (BFS), Depth first search (DFS), Topological Sort, Strongly Connected Components, Euler Path, Articulation Point, Bridge, Bi-connected Components, graph-bicoloring, Floodfill, Dijkstra's Shortest Path Algorithm, Bellman –Ford algorithm and negative cycle detection, Floyd-Warshall all pair shortest
path algorithm, Johnson's algorithm, shortest path in Directed Acyclic Graph. Minimum spanning tree: Prim's algorithm and Kruskal's algorithm.

Self balancing Binary Search Tree: AVL tree (rotation, insertion).

SetOperations: Set representation using bitmask, set/clear bit, querying the status of a bit, toggling bit values, LSB, application of set operations.

String ADT: The concatenation of two strings, the extraction of substrings, searching a string for a matching substring, parsing, Suffix tree, Suffix array.

Textbook

1. Advanced Data Structures, Peter Brass
2. Data Structures – Seymour Lipschutz, Schaum's Outlines Series.
3. Introduction to Algorithms Thomas H. Cormen , Charles E. Leiserson

SWE 128 DATA STRUCTURE LAB

4 Hours/Week , 2 Credits

Creation and Manipulation of linear data structures: linked list, stacks and queues.

Creation and Manipulation of non-linear data structures: B-trees and

heaps, disjoint set.

Implementing sorting, searching and hashing techniques, string processing.

Recursion: permutation, combination. **Sorting:** merge sort, quick sort (randomized quick sort), distribution sort (counting sort, radix sort, bucket sort), lower bounds for sorting, external sort. **Binary Tree:** Binary tree representation using array and pointers, traversal of Binary Tree (in-order, pre-order and postorder). **Ternary tree, Binary Search Tree:** BST representation, basic operations on BST (creation, insertion, deletion, querying and traversing), application- searching, sets. **Ternary search tree, Binary Index tree, Segment tree, RMQ(Range Minimum Query).**

Searching: Application of Binary Search- finding element in a sorted array, finding nth root of a real number, solving equations. **Heap:** Min-heap, max-heap, Fibonacci-heap, applications-priority queue, heap sort.

SetOperations& Disjoint Set: Union find, path compression. **Huffman Coding**

Graph: Graph representation (adjacency matrix/adjacency list), basic operations on graph (node/edge insertion and deletion), traversing a graph: Review of Breadth first search (BFS), Depth first search (DFS), Topological Sort, Strongly Connected Components, Euler Path, Articulation Point, Bridge, Bi-connected Components, graph-bicoloring, Floodfill, Dijkstra's Shortest Path Algorithm, Bellman –Ford algorithm and negative cycle detection, Floyd-Warshall all pair shortest path algorithm, Johnson's algorithm, shortest path in Directed Acyclic Graph. Minimum spanning tree: Prim's algorithm and Kruskal's algorithm.

Self balancing Binary Search Tree: AVL tree (rotation, insertion).

SetOperations: Set representation using bitmask, set/clear bit, querying the status of a bit, toggling bit values, LSB, application of set operations.

String ADT: The concatenation of two strings, the extraction of substrings, searching a string for a matching substring, parsing, Suffix tree, Suffix array.

PHY 102W BASIC PHYSICS LAB

3 Hours/week, 1.5 Credits

Experiments on Heat, Thermodynamics and Optics.

MAT 103 COORDINATE GEOMETRY AND LINEAR ALGEBRA

3 Hours/Week, 3.0 Credits

Coordinate geometry: Equations for straight lines, circles, parabola, ellipse and hyperbola, pair of straight lines; general equations of second degree. Coordinates in three dimensions: equations for straight lines and planes in space; spheres, cylinders and cones. **Matrix:** Matrix and matrix operations; different types of matrices; algebraic operations on matrices; cofactors and minors; determinant of a square matrix; adjoint and inverse of a matrix; elementary transformation of matrices; normal and canonical form of a matrix; rank of a matrix; the row-reduced form of a matrix and rank; equivalent systems of linear equations; the general solution of a system of linear equations; homogeneous systems; eigenvalues and eigenvectors; diagonalization of matrices. **Vector space:** Vector spaces and subspaces; linear dependence and independence; spanning set and basis; coordinates and dimension; null space, row space and column space; change of basis. **Linear transformations:** Linear transformations; composition of transformations; matrix representation; change of basis; diagonalization representation of a linear transformation by a diagonal matrix; the eigenvalues and eigenvectors of a symmetric matrix; quadratic form; functions of a square matrix. **Inner product spaces:** Definition and examples; Cauchy-Schwartz inequality; orthogonality; orthonormal basis and Gram-Schmidt process.

Text:

1. Howard Anton and Chris Rorres: Elementary linear algebra with applications, ninth edition

Reference:

1. Thomas and Finney: Calculus with Analytic Geometry

MAT 107W LINEAR AND ABSTRACT ALGEBRA

3 Hours/Week, 3.0 Credits

Matrix: Introduction to matrices, addition and multiplication of matrices, determinant, Cramer's rule, adjoint and inverse of a matrix, elementary row operations and echelon forms of matrix, rank, row rank, column rank of a matrix and their equivalence, matrix methods for solving system of linear equations.

Vector space: Vector space and subspace over real numbers, direct sum, linear combination, linear dependence and independence of vectors, basis and dimension of vector space, quotient space and isomorphism theorems, inner product space, orthogonal and orthonormal bases.

Linear transformation: Kernel, rank and nullity, matrix representation, change of basis, eigenvalues and eigenvectors, characteristic equations and Caley-Hamilton theorem, diagonalization of matrices, canonical forms, and applications of linear algebra to linear error-control codes.

Groups: Groups and subgroups, cyclic group, multiplication of subgroups, normal subgroups, quotient (factor) groups, centre of a group, permutation groups, homomorphism, isomorphism &automorphism of groups with related theorems & problems, Cayley's theorem, generalized isomorphism theorem, centralizer and normalizer of an element/subset in a group.

Rings: Rings and subrings,ideals,prime, maximal and minimal ideals, principal ideals with related theorems, sum and direct sum of ideals, factor rings, integral domain and field with related theorems and problems, and applications of abstract algebra to algebraic error-control codes.

Books Recommended:

1. Howard Anton and Chris Rorres: Elementary linear algebra with applications, ninth edition

2. Ayers, F.: Matrices
3. Artin, M.: Algebra
4. Lipschutz, S.: Linear Algebra
5. Van Lint, J. H.: Introduction to Coding Theory
6. Paley, H. and Weicheel, P. M.: A First Course in Abstract Algebra

STA 101/STA 101W BASIC STATISTICS AND PROBABILITY

3 Hours/Week, 3.0 Credits

Frequency distribution of data: Population and sample. Collection and representation of statistical data. Tabulation of data. Class intervals. Frequency distribution, discrete, continuous and cumulative distributions. Histograms and frequency polygons. Graphical representation of data.

Statistical measures: Measures of central tendency - arithmetic mean, median, mode, geometric mean, weighted average, harmonic mean. Measures of dispersion - range, standard deviation, variance, coefficient of variation, moments, skewness, kurtosis.

Correlation theory: Linear correlation. Measures of correlation and its significance.

Regression and curve fitting: Linear and non-linear regression. Methods of least squares. Curve fitting.

Probability: Definition of probability and related concepts. Laws of probability. Discrete and continuous random variables. Mathematical expectations. Conditional probability.

Probability distributions: Binomial, poisson and normal distributions and their properties.

Stochastic process. Markov chain (discrete and continuous). Queuing theory - Birth death process in queuing. Examples from computer science. Queuing models. (Elementary concepts).

Text:

1. Statistics –Barlow R J.

Reference:

1. Practical Statistics and Probability –Loveday
2. Principles of Applied Statistics–Melnyk M
3. Probability with Statistical Applications–Mosteller, Rourke & Thomas
4. Theory and Problems of Statistics –Spiegel M R
5. Observation of Errors–Topping

SOC 203W SOCIOLOGY FOR ENGINEERS

3 Hours/Week, 3 Credits

Introducing Sociology:_Definition, Nature, Subject Matter, Sociology and Common Sense, Importance of Sociological Study; The Development of Sociology: The Origins, Early Sociologists (Auguste Comte, Herbert Spencer, Karl Marx, Emile Durkheim, and Max Weber), Modern Developments and Industrial Revolution; Capitalism and Socialism, The Theoretical Perspectives: The Functionalist Perspective, The Conflict Perspective, and The Interactionist Perspective.

Sociological Research Methods: Scientific Methods and their Application ir Sociological Research: Fact, Concept, Variables, Correlations, Control, Hypothesis, Assumption, and Theory; The Methods of Social Research: Historical, Comparative, Statistical, Case-study, Experiments etc; The Research Process: Select the problem, Review the Literature, Formulate a Hypothesis, Choose a Research Design, Collect the Data, Analyze the Results, Draw a Conclusion, Report Writing and Use of SPSS in Sociological Research;

Basic Social Institutions, Marriage: Concept, Forms, and Functions; Family: Concept, Forms, and Functions, Changing Pattern of Marriage and Family in Modern Industrial Society; Culture, Society, and Socialization: Definition, Characteristics, Aspects and Elements of Culture, Cultural Lag, Culture and Civilization, Stages in the Evolution of Human Civilization; Agencies of Socialization: Family, Schools, Peer Groups, Mass Media etc;

Social Change and Social Stratification: Concept of Social Change, Social Evolution, Social Progress, and Social Development. Factors of Social Change and Its Impacts on Society; Social Stratification: of Concept, Forms, Social Stratification and Social Mobility; Social Problems and Applied Sociology: Concept of Social Problems;

Major Social Problems: Crime, Juvenile Delinquency, Drug Addiction etc. Concept, Scope, Role of Sociologist in Applied Sociology; Social Policy and Planning: Objectives and prerequisites of Social Planning;

Globalization: Information and Communication Technology: Concept and Areas of Globalization, Impact of Globalization on Society, The Rise of Information and Communication Technology. Dimensions of Globalization: Technological and Information globalization; Technology and Society: Concept, Technological Innovation, and Technological Fix (Alvin Weinberg-1966), Technology and Society: Effects of technological factors on social life and Influence of Technology on Social Institution.

References: 1. Fairchild, Henry Pratt. Dictionary of Sociology. 2. Kalam, Abul. Globalization and Bangladesh-In the New Century. 3. Koenig, Samuel. Sociology-An Introduction to the Science of Society. 4. Ogburn, William F. and Nimkoff, Meyer F. Sociology. 5. Robertson, Ian. Society-A Brief Introduction. 6. Rao, Shankor. Sociology. 7. Young, P.V. Scientific Social Survey and Research.