

Second Year: Semester I

Course No	Course Title	Hours/Week	Credits
		Theory + Lab	
SWE 222	Introduction to Competitive Programming	0 + 4	2
SWE 223	Object Oriented Programming	3 + 0	3
SWE 224	Object Oriented Programming Language Lab	0 + 4	2
SWE 225	Software Requirement Engineering	2 + 0	2

SWE 226	Software Requirement Engineering Lab	0 + 3	1.5
CSE 219W	Computer Architecture	3 + 0	3
BUS 201W	Cost and Management Accounting	3 + 0	3
ECO 205W	Principles of Economics	3 + 0	3
Total		14 + 11 = 25	19.5

Second Year : Semester II**SWE 222 INTRODUCTION TO COMPETITIVE PROGRAMMING***4 Hours/Week, 2 Credits*

Data Structure: Trie Tree, BIT, Segment Tree, Splay Tree, MO's Algorithm, Square Root Decomposition, Heavy Light Decomposition, Persistent Data Structure (Segment Tree, Trie), DSU on Tree, Treap, K-D Tree, KNN Tree, Sparse Table

String Processing: KMP, Suffix Array, Suffix Automata, Suffix Tree, Palindromic Tree, Aho-Corasick, Manacher Algorithm, Extended KMP, Hashing (Rolling Hash).

Game Theory: Nim Game, Sprague-Grundy Value, Green Hackenbush, Blue Red Hackenbush, Blue Red Green Hackenbush, Colon Principle, Fusion Principle.

Combinatorics & Probability: Burnside Lemma, Inclusion Exclusion, Combination, Permutation, Catalan Number, Stirling Number, Probability, Expected Value.

Number Theory: Chinese Remainder Theorem, Euler Phi, Extended Euclid, Prime Factorization, Mobius Function, Primitive Prime, Huge Mod.

Basic Math: FFT, DFT, NTT, Gaussian Elimination, Matrix Exponentiation.

Basic Geometry: Fundamental Concepts of Geometry, Closest Pair of Point, Convex Hull, Rectangle Union, Circle Union, Polygon Clipping, Line Sweep, Line Intersection.

Reference:

1. Art of Programming Contest – Ahmed Shamsul Arefin.
2. 102 Combinatorial Problems – Titu Andreescu & Zuming Feng
3. Problem-Solving Methods in Combinatorics – Pablo Soberón
4. Competitive Programming 3 – Steven Halim

SWE 223 OBJECT ORIENTED PROGRAMMING LANGUAGE

3 Hour/week, 3 Credits

Introduction to Java: History of Java, Java Class Libraries, Introduction to Java Programming, A simple Program. **Developing Java Application:** Introduction, Algorithms, Pseudo code, Control Structure, The If /Else Selection Structure, The While Repetition Structure, Assignment Operators, Increment and Decrement Operators, Primitive Data Types, Common Escape Sequence, Logical Operator.

Control Structure: Introduction, The For Structure, The Switch Structure, The Do/While Structure, The Break and Continue Structure. **Methods:** Introduction, Program Module in Java, Math Class Methods, Method Definitions, Java API Packages, Automatic Variables, Recursion, Method Overloading, Method of the Applet Class. **Arrays :** Introduction, Arrays, Declaring and Allocating Arrays, Passing Arrays to Methods, Sorting Arrays, Searching Arrays, Multiple-Subscripted Arrays.

Object-Based Programming: Introduction, Implementing a Time Abstract Data Type with a Class, Class Scope, Controlling Access to Members, Utility Methods, Constructors, Using Overload Constructor, Using Set and Get Method, Software Reusability, Friendly Members, Finalizers, Static Class Members, Data Abstraction and Information Hiding.

Object-Oriented Programming: Introduction, Superclasses and Subclasses, Protected Members, Using Constructor and Finalizers in Subclasses, Composition vs. Inheritance, Introduction to polymorphism, Dynamic method building, Final Methods and Classes, Abstract Superclasses and Concrete Classes. **String and Characters, Graphics, Exception**

Handling, Files and Stream, Java API, Utility Classes, 2D Graphics, GUI, Swing, Events.

Textbook

1. Introduction to Programming in Java, Robert Sedgewick & Kevin Wayne.
2. An Introduction to Object-Oriented Programming, Timothy Budd.

SWE 224 OBJECT ORIENTED PROGRAMMING LANGUAGE LAB

4 Hours/Week, 2.0 Credits

Object-Oriented Programming: Classes and objects, Constructors and destructor, Encapsulation of class members and methods, Manipulating objects. **Dynamic Memory Allocation:** Pointers to objects, Pointers and arrays, Call-by-reference and call-by-value. **Concept of Inheritance, Interface and Polymorphism:** Direct and indirect inheritance, Private and protected members of inherited class, Constructors and destructors under inheritance, Polymorphism, Abstract base classes. **Exceptions:** Error handling in program, Creating own exception. **Handling Files:**

Input/Output streams, Processing files, Random access files. **Thread Programming:** Introduction to threads, Using threads to solve multi-tasking problems, Thread synchronization. **Client-Server programming:** Applet and Servlets, Introduction to JSP, Socket programming. GUI: Basic user interface design using Java swing. **Understanding Java Enterprise Level Works.**

SWE 225 SOFTWARE REQUIREMENT ENGINEERING

2 Hours/Week, 2 Credits

Introduction : The Business Case for Requirements Analysis, Requirements Analysis through Software Life Cycles, Requirements Analysis based on the Nature of Software Development, Requirement Specification, Quality Assurance Methods, The Nature of Meetings, Understanding Requirements, System Planning Approaches, Requirements Validation and Testing, **Requirements Analysis in Detail :** System Scope Models, Universal Modeling Language (UML), The Requirements Document, The Specifications Document, Software Tools Assisting Development of Requirements and Specifications. **Advanced Topics in Requirements Analysis :** User Interface Design, Data Flow Modeling, Viewpoint Oriented Requirements Methods, Non Functional Requirements (Performance, Safety Critical Systems) **Formal Methods :** Introduction to Formal Methods, Formal Methods in Industrial Applications, Underpinnings of Formal Methods, Z and B for producing specifications.

Text:

1. Software Requirements Analysis and Specifications – Jag Sodhi

Reference:

1. Software Requirements Engineering–Richard H. Thayer, Merlin Dorfman, Sidney C. Bailin
2. Innovations for Requirement Analysis–Barbara Paech, Craig Martell

SWE 226 SOFTWARE REQUIREMENT ENGINEERING LAB

2 Hours/Week, 1 Credits

Case Study, Requirement Analysis and Specification on real life projects, Use of Design tools, Use of validation tools.

CSE 219W COMPUTER ARCHITECTURE

3 Hours/Week, 3 Credits

Introduction to Computer Architecture: Overview and history; Cost factor; Performance metrics and evaluating computer designs. **Instruction set design:** Von Neumann machine cycle, Memory addressing, Classifying instruction set architectures, RISC versus CISC, Micro programmed vs. hardwired control unit. **Memory System Design:** Cache memory; Basic cache structure and design; Fully associative, direct, and set associative mapping; Analyzing cache effectiveness; Replacement policies; Writing to a cache; Multiple caches; Upgrading a cache; Main Memory; Virtual memory structure, and design; Paging; Replacement strategies. **Pipelining:** General considerations; Comparison of pipelined and nonpipelined computers; Instruction and arithmetic pipelines, Structural, Data and Branch hazards. **Multiprocessors and Multi-core Computers:** SISD, SIMD, and MIMD architectures; Centralized and distributed shared memory- architectures;

Multi-core Processor architecture. Input/output Devices: Performance measure, Types of I/O device, Buses and interface to CPU, RAID. Pipelining: Basic pipelining, Pipeline Hazards. Parallel Processing.

Textbook

1. John P.Hayes, "Computer Architecture and Organization".
2. David A.Patterson and John L.Hennessy, "Computer Organization and Design: The hardware / software interface".

BUS 201W COST AND MANAGEMENT ACCOUNTING

3 Hours/Week, 3 Credits

Introduction: *Cost accounting:* Definition, Limitations of Financial Accounting, Importance, Objectives, Functions and Advantages of Cost Accounting, Financial Accounting VS. Cost Accounting VS. Managerial Accounting, Techniques and Methods of Cost Accounting, International Cost Accounting Systems. *Managerial accounting:* Definition, Evolution, Objectives, Scope, Importance, Functions, Techniques, Differences among Managerial Accounting, Cost Accounting and Financial Accounting, Management Accounting for Planning and Control. **Cost Classification:** Cost Concepts, Cost Terms, Cost Expenses and Losses, Cost Center, Cost Unit, Classification of Costs, Cost Accounting Cycle, Cost Statement, The Flow of Costs in a Manufacturing Enterprise, Reporting and Results of Operation. **Materials:** Indirect & Direct Material, Procurement of Materials, Purchase Control, Purchase Department, Purchase Quantity, Fixed Order, Economic Order Quantity, Stock-out Cost, Re-order Level, Purchase Order, Receipts and Inspection, Classification and Codification of materials, Stock Verification, ABC Method of Store Control, Pricing of materials Issued, LIFO, FIFO and Average Pricing, Inventory Control; **Contract Costing:** Introduction, Procedures, Types of Contract, Retention Money, Profit or Loss on Incomplete Contract, Cost plus Contract Systems; **Operation Costing:** Nature, Procedures, Costing for Transport and Hospital; **Cost Behavior:** Analysis of Cost Behavior, Measurement of Cost Behavior, Methods of Measuring Cost Functions, Analysis of Mixed Costs, High and Low Point Method, Scatter graph Method, Least Squares Method, Use of Judgment in Cost Analysis; **Cost – Volume Profit Relationship:** Profit Planning, Break Even Point, Break Even Chart, Changes in Underlying Factors, Profit Volume Graph, Income Tax effect on Break Even Point, Break Even Point in Decision Making, Risk and Profit Analysis, Limitations.

Text Book:

1. Basu & Das: Theory and Practice of Costing
2. Managerial Accounting by Garrison and Noreen

Reference:

1. Management Accounting – Ray .H. Garrison
2. Management Accounting – Usry & Hammer
3. Cost Accounting – L.G. Rayburn
4. Cost Accounting – S.P Lyenger

ECO 205W PRINCIPLE OF ECONOMICS

3 Hours/Week, 3.0 Credits

1. Introduction to Microeconomics: Definition and scope; basic concepts and tools—PPF and circular flow model; fundamental economic problems and solution systems; Concepts of demand, supply and equilibrium; concepts of total and marginal utility; concepts of production, cost and profit, characteristics of different types of markets.

2. Introduction to Macroeconomics: Key macroeconomic indicators and their performance measurement - GNP, GDP, inflation, unemployment; money, functions of money, function of commercial and central bank, monetary policy; ; fiscal policy and structure of govt. budget.

3. Development and related issues: Growth and development; concept of poverty and poverty measures; HDI; key human-socio-economic development indicators of Bangladesh.

Recommended Books:

1. Arnold, R. A. (2014): Economics, South Western Publishing Company, Eleventh Edition
2. Bangladesh Economic Review relevant issues.
3. Mankiw, N. G. (2012): Principles of Economics, Thomson South Western Publishing, Sixth Edition
4. Samuelson, P. A. and Nordhaus, W. D. (2009): Economics, McGraw-Hill USA, Nineteenth Edition.
5. Todaro, M. P. and Smith, S. C. (2012): Economics of Development in the Third World, Longman, Eleventh Edition