

পরীক্ষা নিয়ন্ত্রকের অফিস

ঢাকা বিশ্ববিদ্যালয়

ফোনঃ(অফিস)৮৬১৩২৮০

৯৬৬১৯০০-৫৯/৪০৮০

ফ্যাক্সঃ৮৮০-২-৯৬৬৭২২২

Email:co_letter@du.ac.bd



মেমো নং: ১০৪৫/শা-৫/প.

তারিখঃ ২৪ আগস্ট ২০২১
১৭ অগ্রহায়ণ ১৩৭৬

লামিসা কাইয়ুম শাম্মা

প্রভাষক

ইংরেজী বিভাগ

ঢাকা বিশ্ববিদ্যালয়

ঢাকা - ১০০০।

জনাব,

আপনাকে জানাইতেছি যে, ২০২১ সনের Final পরীক্ষার Introduction to poetry বিষয়ে কোর্স/পত্র নং 101 এর বাংলা ও ইংরেজি উভয় ভাষার প্রশ্নপত্র প্রণয়ন করার জন্য আপনাকে যুগ্ম প্রশ্নপত্র প্রণেতা ও পরীক্ষক নিয়োগ করা হইয়াছে।

বিশেষ নির্দেশনাবলীঃ

উল্লেখিত প্রশ্নপত্র প্রণয়ন প্রসঙ্গে আনুসঙ্গিক তথ্যাবলী সম্বলিত নিম্নলিখিত কাগজপত্র এতদসঙ্গে গ্রথিত হইলঃ(১)প্রশ্নপত্র প্রণেতাদের প্রতি নির্দেশনাবলী (২) নির্ধারিত পাঠ্যসূচী (৩) সংশ্লিষ্ট পত্রের পূর্ববর্তী বৎসরের প্রশ্নপত্র (৪) প্রশ্নপত্র প্রণয়নের জন্য রেখাঙ্কিত কাগজ (৫) ঠিকানা যুক্ত ছোট বড় প্রয়োজনীয় খাম।

প্রণীত প্রশ্নপত্র গ্রথিত খামে সিলমোহর পূর্বক বীমাকৃত ডাকে অথবা ব্যক্তিগতভাবে ২০২১-০৮-২৬ ইং তারিখের মধ্যে ঢাকা বিশ্ববিদ্যালয়ের সংশ্লিষ্ট বিষয়ের পরীক্ষা কমিটির চেয়ারম্যান প্রফেসর/ড/জনাব Mr. Abdul এর নিকট জমা দেয়ার জন্য আপনাকে সবিনয় অনুরোধ করিতেছি। সরবরাহকৃত ছোট খামের শূন্যস্থানগুলি যথাযথভাবে পূরন করা প্রয়োজনীয়।

আপনার প্রণীত প্রশ্নপত্র নির্ধারিত তারিখের মধ্যে পাওয়া না গেলে বিশ্ববিদ্যালয় কর্তৃপক্ষ বিকল্প ব্যবস্থা গ্রহণ করিতে বাধ্য হইবে। নিযুক্তিপত্র গ্রহণে অপারগ হইলে অবশ্যই ইহার কারণ জানাইয়া সঙ্গে এতদসংলগ্ন কাগজপত্রাদিও ফেরত পাঠানোর জন্য আপনাকে অনুরোধ করিতেছি।

প্রণয়নকৃত প্রশ্নপত্রের পান্ডুলিপি পরিষ্কার পরিচ্ছন্ন ও সুস্পষ্ট হওয়া একান্ত বাঞ্ছনীয়। কোন ছক বা অন্য কোন তথ্যাদি প্রশ্নপত্রের সঙ্গে সরবরাহ করার প্রয়োজন হইলে তাহা পৃথকভাবে সংশ্লিষ্ট চেয়ারম্যানকে সঠিক নির্দেশিকা প্রদান করিতে অনুরোধ করিতেছি।

আপনার কোনো নিকট আত্মীয় যেমনঃ (১) ভাই (২) বোন (৩) স্ত্রী/স্বামীর (ক) ভাই/বোন (৪) ছেলে (৫) মেয়ে (৬) ভ্রাতৃবধূ (৭) ভগ্নিপতি (৮) স্ত্রী (৯) স্বামী (১০) ভাই ও বোনের সন্তানের (১১) পুত্রবধূ (১২) জামাতা (১৩) আপন চাচা-চাচী (১৪) আপন মামা-মামী (১৫) আপন ফুফা-ফুফু এবং (১৬) আপন খালা-খালু এই পরীক্ষায় যদি পরীক্ষার্থী/পরীক্ষার্থিনী থাকে, তবে তাহা নিয়োগপত্র গ্রহণের পূর্বে অত্র অফিসে জানানোর জন্য অনুরোধ করিতেছি।

আপনি যদি শিক্ষা প্রতিষ্ঠান/বিভাগ ছাড়া অন্য কোন সরকারী দপ্তরের কর্মকর্তা হন, তবে আপনাকে এই কাজের পারিশ্রমিক গ্রহণের জন্য সরকারী অনুমোদন পত্র বিলের সহিত গ্রথিত করিয়া দিতে হইবে। সরকারী কর্মচারীদের নিযুক্ত গ্রহণের পূর্বে অবশ্যই কর্তৃপক্ষের অনুমতি নিতে হইবে।

উক্ত বিষয়ে আপনার সম্মতি যথাশীঘ্র জানাইবার জন্য অনুরোধ করিতেছি।

আপনার বিশ্বস্ত

পরীক্ষা নিয়ন্ত্রকের পক্ষে

পরীক্ষা উপ-নিয়ন্ত্রক

**INSTITUTE OF INFORMATION TECHNOLOGY
UNIVERSITY OF DHAKA**



<http://www.iit.du.ac.bd/>

**BACHELOR OF SCIENCE IN SOFTWARE ENGINEERING
(BSSE)**

[Session 2017 – 2018]

**Institute of Information Technology
University of Dhaka**

**Syllabus for
Bachelor of Science in Software Engineering**

Semester 1

Course Code	Course Title
CSE101	Structured Programming
CSE 102	Discrete Mathematics
STAT 103	Probability and Statistics for Engineers I
MATH 104	Calculus and Analytical Geometry
GE 105	Sociology
SE 106	Introduction to Software Engineering
6 Courses	

Semester 2

Course Code	Course Title
CSE 201	Data Structure and Algorithm
CSE 211	Computer Organization
STAT 203	Probability and Statistics for Engineers II
MATH 204	Ordinary Differential Equations
GE 212	Bangladesh Studies
SE 206	Object Oriented Concepts I
6 Courses	

Semester 3

Course Code	Course Title
CSE 301	Combinatorial Optimization
SE 312	Theory of Computing
CSE 311	Computer Networking
MATH 304	Numerical Analysis for Engineers
SE 305	Software Project Lab I
SE 306	Object Oriented Concepts II
6 Courses	

Semester 4

Course Code	Course Title
CSE 401	Operating System and System Programming
GE 402	Business Psychology
CSE 411	Information Security
CSE 404	Database Management System I
BUS 405	Business Studies for Engineers
SE 406	Software Requirements Specification and Analysis
6 Courses	

Semester 5

Course Code	Course Title
SE 511	Professional Ethics for Information Systems
CSE 502	Web Technology
BUS 503	Business Communications
CSE 504	Database Management System II
SE 505	Software Project Lab II
SE 506	Design Patterns
6 Courses	

Semester 6

Course Code	Course Title
CSE 601	Distributed Systems
SE 611	Software Metrics
SE 612	Software Security
CSE 604	Artificial Intelligence
SE 605	Software Testing and Quality Assurance
SE 606	Software Design and Analysis
6 Courses	

Semester 7

Course Code	Course Title
SE 701	Internship
1 Course	

Semester 8

Course Code	Course Title
SE 801	Project
SE 811	Software Maintenance
SE 803	Software Project Management
CSE / SE / BUS 8XX	Elective
CSE / SE / BUS 8XX	Elective
5 Courses	

Elective Courses

No.	Course Code	Course Title
1.	CSE 802	Computer Data and Network Security
2.	CSE 823	Embedded Systems
3.	BUS 824	Numeric Computation for Financial Mod
4.	CSE 825	Data Mining and Warehousing
5.	BUS 827	Enterprise Information Systems
6.	CSE 829	Pattern Recognition and Image Processing
7.	CSE 830	Mobile and Wireless Computing
8.	CSE 831	Computer Graphics and Multimedia
9.	CSE 837	Machine Learning
10.	CSE 839	Human Computer Interaction
11.	CSE 840	Information Retrieval
12.	BUS 842	Strategic Management
13.	CSE 844	Applied Data Science

Semester 1 (1st year 1st Semester)

Course Title: Structured Programming

Code: CSE 101

Credit: 3 Credits (1 Credit Theory and 2 Credit Lab)

Course Outline: Fundamentals of C programming; Introducing C's Program; Data types, Variables and Expressions; Exploring Arrays and Strings; User-Defined Functions; Console and File I/O; Structures and Unions.

References:

1. Teach Yourself C, Herbert Schildt, McGraw Hill
2. C: The Complete Reference, Herbert Schildt, McGraw Hill
3. Schaum's Outline of programming with C, McGraw Hill

Course Title: Discrete Mathematics

Code: CSE 102

Credit: 3 Credits (3 Credit Theory)

Course Outline: The Foundations: Logic and Proofs: proposition logic, propositional logic, propositional equivalences, predicates and quantifiers; **Basic Structures:** Sets, Functions, Matrices; **Number Theory:** The division algorithm, divisibility and the Euclidean algorithm; **Induction and Recursion:** Induction, Recursive Definitions and Structural Induction, Program Correctness; **Combinatorics:** Addition and multiplication rules, The principle of Inclusion-Exclusion, Permutations, combinations, Generalized Permutations and Combinations; **Relations and Functions:** Symmetry, transitivity, Equivalence classes, congruence, closure of relations, partial orderings; **Graphs:** Graph Terminology and Special Types of Graphs, Representing Graphs, Graph Connectivity, Euler and Hamilton Paths; **Trees:** Introduction to Trees, Spanning Trees.

References:

1. Discrete Mathematics and its Applications, Seventh Edition by Ke

Course Name: Probability and Statistics for Engineers I

Code: STAT 103

Credit: 3 Credits (3 Credit Theory)

Course Outline: Introduction to Statistics: Concept of Data and Variation; Descriptive Statistics, Inferential Statistics, Populations and Samples; Frequency Tables and Graphs, Relative Frequency Tables and Graphs, Cumulative Frequency Tables and Graphs, Ogives, Stem and Leaf Plots, Sample Mean, Sample Median, Sample Mode, Sample Standard Deviation, Sample Percentiles and Box Plots, Chebyshev's Inequality; **Elements of Probability:** Paired Data Set and Sample Correlation Coefficient; **Elements of Probability:**

in Probability, Sample Space and Events, Venn Diagrams and Algebra of Probability, Conditional Probability, Bayes' Theorem and Independent Events; **and Expectation:** Random Variables, Types of Random Variables, Joint Probability Functions, Expectation, Property of Expected Values, Use of Expected Values, Variance, Covariance and Variance of Sums of Random Variables; **Special Functions:** **Special Random Variables:** Binomial Random Variables, Poisson Random Variables, Uniform Random Variables, Normal Random Variables, Exponential Random Variables; **Distributions:** Normal Distribution, Chi-Square Distribution, t-Distribution and F-Distribution; **Statistics:** Central Limit Theorem, Sampling Distribution for Normal Population from a Finite Population; **Parameter Estimation:** Maximum Likelihood Estimates, Estimating the difference in Means of Two Normal Populations, Confidence Interval for the Mean, Confidence Interval of the Mean of the Exponential Distribution, Estimator.

References:

1. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, John Wiley & Sons, 3rd Ed.
2. M. Nurul Islam, An Introduction to Statistics and Probability, Book 1, 2nd Ed, New York, McGraw-Hill, 1st Ed
3. Lipschutz, Lipschutz Seymour, 2000 Solved Problems in Discrete Mathematics, McGraw-Hill, 1st Ed

Course Title: Calculus and Analytical Geometry

Code: MATH 104

Credit: 3 Credits (3 Credit Theory)

Course Outline: Basic Concepts: Real Numbers and Real Lines, Polar Coordinates, Functions, Algebra of Functions, Inverse Functions, Quadratic Equations, Graphs, Trigonometric Functions, Complex Numbers, Inequalities, Infinite Sequences, Taylor Series, Rate of Change and Limit, Rules of Finding Limits, For Extension of the Limit Concepts, L'Hospital's Rule, Continuity, Taylor's Theorem; **Calculus:** The Derivatives of a Function, Differentiation Rules, Rates of Change of Functions, Trigonometric Functions, Chain Rule Differentiation, Implicit Differentiation, Related Rates of Change, Extreme Values of Functions, Mean Value Theorem, First Derivative and Second Derivative Tests for Extreme Values, Optimization Problems; **Differential Equations and Newton's Method;** **Integral Calculus:** Indefinite Integrals, Substitution, Riemann Sums, Definite Integral, Fundamental Theorem of Calculus, Theorem, Substitution in Definite Integrals, Areas between Curves, Finite and Infinite Volumes of Solids of Revolution, Cylindrical Shells, Lengths of Plane Curves, Surface Area of Solids of Revolution, Moments and Center of Mass, Fluid Pressures and Forces, Improper Integrals, Multiple Integrals and Line Integrals; **Linear Algebra:** Matrices, Operation on Matrices, Inverse of a Matrix, Rank of Matrix, Determinants, Solutions of System of Linear Equations, and Eigen value Problems.

References:

1. G.B. Thomas and R.L. Finney, *Calculus and Analytical Geometry*, McGraw-Hill, 2nd Ed.
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 9th Ed.

Course Title: Sociology

Code: GE 105

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

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

Sociological Research Methods: Scientific Methods and their Application in Research: Fact, Concept, Variables, Correlations, Control, Hypothesis, The Methods of Social Research: Historical, Comparative, Statistical, Case Study, The Research Process: Select the problem, Review the Literature, Formulate a Research Design, Collect the Data, Analyze the Results, Draw a Conclusion; Use of SPSS in Sociological Research;

Basic Social Institutions, Marriage: Concept, Forms, and Functions; Family and its Functions, Changing Pattern of Marriage and Family in Modern Indian Society, and Socialization: Definition, Characteristics, Aspects and Elements; Socialization: Family, Schools, Peer Groups, Mass Media etc;

Social Change and Social Stratification: Concept of Social Change, Social Progress, and Social Development. Factors of Social Change and Its Impact; Social Stratification: of Concept, Forms, Social Stratification and Social Mobility; Applied Sociology: Concept of Social Problems; Major Social Problems like Crime, Delinquency, Drug Addiction etc. Concept, Scope, Role of Sociologist in Social Policy and Planning: Objectives and prerequisites of Social Planning;

Globalization: Information and Communication Technology: Globalization, Impact of Globalization on Society, The Rise of Information and Communication Technology. Dimensions of Globalization: Technological and Institutional; Technology and Society: Concept, Technological Innovation, and Technology (Alvin T. Weinberg-1966), Technology and Society: Effects of technological innovation on Society; 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.

<p>Course Title: Introduction to Software Engineering Code: SE 106 Credit: 3 Credits (3 Credit Theory)</p>

Course Outline: Overview of Software Engineering: history, nature of software engineering to other discipline, software development life cycle, **Software nature and qualities:** product qualities, project qualities, usability, maintainability, portability, quality measurements; **Software engineering processes:** requirement, design, development, testing, maintenance; Software development models: waterfall, agile, spiral, RDD, V model; **Software engineering principles:** modular, object oriented, component oriented, structured.; **Specification and Verification:** specification, descriptive specification, testing, analysis, debugging; **Modeling:** of modeling diagram, UI design. **Software Project Management:** cost estimation, risks management.

References:

1. Fundamentals of Software Engineering, 2nd Edition, by Carlo Ghisetti, Education.
2. Software Engineering: A Practitioner's Approach, 7th Edition, Education.

Course Title: Data Structure and Algorithm

Code: CSE 201

Credit: 3 Credits (1 Credit Theory and 2 Credit Lab)

Outline: Introduction - Data Structures and Complexity of Algorithms; Searching Techniques: Linear and Binary Searching; Sorting and Recursion; Common Sorting Techniques: Insertion Sort, Selection Sort, Bubble Sort, Merge Sort, Radix Sort; Factorial and Tower of Hanoi Problem; Linked Lists - Abstract Data Type and Linked Lists: Singly, Two Way and Circular Linked Lists; Stacks and Queues and their Implementation Strategies; Prefix, Infix and Postfix Expression Transformation and Evaluation Algorithms; Hashing - Hash Indices and Linear Probing, Dynamic Hashing, Collisions in Hash Indices and Collision Resolving Techniques; Concepts, Binary Tree, BST, Heaps, Heap Sort, Huffman Encoding Technique and B+ Tree; Graphs - Graph Terminologies, Representing Graphs, Graph Traversal: BFS, DFS, Shortest Path Problems, Minimum Spanning Tree, Minimum Spanning Tree Algorithms; Topological Sorting; Problem Solving Strategy - Greedy Algorithms, Divide and Conquer, Dynamic Programming and Backtracking.

References:

1. *Data Structures*. Schaum's Outline Series.
2. E. Horowitz and S. Sahni, *Fundamentals of Data Structures*, Longman.
3. Robert L. Kruse, *Data Structures and Program Design*, Prentice Hall.

Course Title: Probability and Statistics for Engineers II

Code: STAT 203

Credit: 3 Credits (3 Credit Theory)

Course Outline: Hypothesis Testing: Tests Concerning the Mean of a Normal Population, the Equality of Means of Two Normal Populations, Hypothesis Tests Concerning the Variance of a Normal Population, Hypothesis Tests in Bernoulli Populations and Tests Concerning the Poisson Distribution. Regression and Correlation Analysis: Least Squares Regression Parameters, Distribution of the Estimators, Statistical Inference Concerning Regression Parameters, Coefficient of Determination and Sample Correlation Coefficient, Residuals, Transforming to Linearity, Weighted Least Squares, Polynomial Regression, Linear Regression, Logistic Regression Models for Binary Output Data. Analysis of Variance: One-way Analysis of Variance, Two-Factor Analysis of Variance, Introduction and Parameter Estimation, Testing Hypotheses and Two-way Analysis of Variance with Interaction Problems. Goodness of Fit Tests and Categorical Data Analysis: Chi-Square Tests when All Parameters are Specified, Goodness of Fit Tests when Some Parameters are Unspecified, Tests of Independence in Contingency Tables, Tests of Independence in Contingency Tables Having Fixed Marginal Totals and Kolmogorov-Smirnov Goodness of Fit Test for Continuous Data. Nonparametric Hypothesis Tests: Sign Test, Signed Rank Test, Mann-Whitney U-Test, Problem and Runs Tests for Randomness. Quality Control: Control Charts for the Mean, X-Control Chart, S-Control Charts, and Control Charts for the Fraction Defective, p-Control Chart for Number of Defects and Other Control Charts for Detecting Changes in Process.

References:

1. Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists.

- Elsevier/Academic Press, 3rd Ed.
2. Douglas C. Montgomery and George C. Runger, Applied Statistics Engineers, John Wiley and Son, 4th Ed.
 3. Murray R Spiegel, John J Schiller, R Alu Srinivasan, Schaum's Outline of Statistics, McGraw Hill, 3rd Ed.

Course Title: Ordinary Differential Equations

Code: MATH 204

Credit: 3 Credits (3 Credit Theory)

Course Outline: Differential Equations and Mathematical Modeling Separable Differential Equations, Exact Differential Equations, Linear Bernoulli Equation, Homogeneous Linear Equations of Second Order, Second Order Equations with Constant Coefficients, Euler-Cauchy Equation, Existence and Uniqueness of Solutions, Non-homogeneous Equations, Solution by Undetermined Coefficients, Variation of Parameters, Higher-Order Linear Differential Equations, Higher-Order Non-homogeneous Equations with Constant Coefficients, and Higher-Order Non-homogeneous Equations with Variable Coefficients, Eigenvalues, Homogeneous Systems with Constant Coefficients, Critical Points, Stability, Qualitative Methods for Nonlinear Systems, Phase Plane Systems, Laplace Transform, Inverse Transform, Transforms of Derivatives and Integrals, Differentiation and Integration of Transforms, Convolution, and Partial Differential Equations.

References:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley and Sons, 10th Ed.
2. S.L. Ross, *Differential Equations*.
3. Earl A. Coddington, *An Introduction to Ordinary Differential Equations*, Wiley Publications, Unabridged Ed.
4. Morris Tenenbaum and Harry Pollard, *Ordinary Differential Equations*, Wiley Publications, 1985 Ed.

Course Title: Object Oriented Concepts I

Code: SE 206

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Object Oriented Concepts - Introduction to Object Oriented Programming, Procedural vs Object Oriented (OO) Programming, What is an Object – Class and Object, What is a Class – Attributes, Methods and Messages, Using UML to Model a Class, Encapsulation and Data Hiding: Interfaces and Implementations, Inheritance, Subclasses, Abstraction and Is-a Relationships; Polymorphism, Composition, Association Relationships; How to think in terms of Objects – Interface vs Implementation, when designing Interfaces and Giving the user minimal Interface presentation, Designing concepts in details – Constructors: Default constructor, When is a class allowed to have multiple constructors and The design of constructors, Error handling and Exception Handling, Anatomy of a Class – The Name, Comments, Attributes, Constructors, Access Modifiers, Methods and Private implementation methods; Class Design Guidelines, Designing Systems, Identifying Public Interfaces, Designing Robust Constructors, Designing a Class, Documenting a Class and Using Comments, Designing for Maintainability in Mind and Using Object Persistence; Designing with Object Oriented Statement of Work, Requirements Collection, Prototype of User Interface.

Determining the responsibilities of Each Class, Class Collaboration, Class System; Mastering Inheritance – Reusing Objects, Generalization and Inheritance weakens Encapsulation; Frameworks and Reuse – Writing Frameworks, Contract: Abstract Classes and Interfaces. **Programming Java** – Java Virtual Machine (JVM) and Java Runtime (JRE), Java Integrated Development Environment (IDE) for Java, Java installation, compiling and running Java program, using Java classpath and JVM Arguments; Package, Import, Class, Fields, Methods, Constructors, Primitive data types; Wrapper class, Nonexistence type: null. Object Oriented Programming (OOP) to implement each of the object oriented concepts which are discussed in support practical OOP – String Operations: String creations and operations of String, String comparison and searching, String buffers and builders; and Output Stream, File, Path, Directory and tree; Exception handling: exception vs unchecked exceptions, throw and throws, Common exceptions; Logger and Debugging: Logger, Log levels, Formatters and Handlers and Manager, Configuration, Introduction to Debugging and Debugging Tools.

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

Course Title: Computer Organization

Course Code: CSE 211

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Outline: Introduction: Function and structure of a computer, Functions of a computer, Interconnection of components, Performance of a computer; **and arithmetic:** Binary, octal, and hexadecimal numbers, One's and two's complement representations, Addition and subtraction; **Digital logic and integrated circuits:** Combinational circuits - adders, shifters, decoders, multiplexers and ROMs; Sequential circuits - registers, counters and RAM); **Representation of Instructions:** Operands, Addressing modes, Instruction formats, Instruction sets, Instruction sets in CISC and RISC architectures; **Introduction to Assembly Language:** Properties of assembly language, The assembly process, Linking and loading, Register-level debugging; **Processing Unit:** Organization of a processor - Registers, ALU and Control Unit; CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Micro-programmed control unit; **Memory Subsystem:** Memory cells - SRAM and DRAM cells, Internal Organization of a memory unit, Error correction memories, Interleaved memories, Cache memory, Cache memory, Mapping methods, Organization of a cache memory, Cache coherence mechanisms, Memory management unit - Concept of virtual memory, Hardware support for memory management; **Input/Output Subsystem:** I/O ports, I/O control mechanisms - Program controlled I/O, Interrupt controlled I/O, I/O interfaces - Serial port, Parallel port, PCI bus, SCSI bus, InfiniBand, I/O peripherals - Input devices, Output devices, Secondary storage; **Multiprocessing Systems:** Shared memory multiprocessor, Message passing, Hardware multithreading

References

1. D. A. Patterson and J. L. Hennessy, "Computer Organization Hardware/Software Interface", Morgan Kaufmann, 1998.
2. C. Hamacher, Z. Vranesic and S. Zaky, "Computer Organization",
3. W. Stallings, "Computer Organization and Architecture - Design Principles", Prentice Hall of India, 2002.
4. J.P. Hayes, "Computer Architecture and Organization", McGraw-

Course Title: Bangladesh Studies

Course Code: GE 212

Credit: 3 Credits (3 Credit Theory)

Outline: Introduction to the course and its objectives, History and Social Structure of Bangladesh, British rule and Pakistan rule: The impact of British and Pakistan rule on the education of the people. Language Movement of 1952, Events Leading to 1969, War of Independence and the Emergence of Bangladesh in 1971, Constitution of Bangladesh. Three branches of government- executive, legislative and judiciary, Formation and development of political parties in Bangladesh and Constitutional development of Bangladesh.

Geography and Resources of Bangladesh: Location, Area, Boundary, Climate, Soil, Water System, Climate, People and Resources of Bangladesh, **Social Structure of Bangladesh:** society, Urban society, Family, household, and kinship, Women's role in society.

Bangladesh: Language, Literature, Art and Culture of Bangladesh, **Economy of Bangladesh:** Major Economic Sectors, potentials of various sectors and their prospects, challenges and development, role of donor agencies, role of NGOs, **Achievements of Bangladesh:** **Bangladesh:** Economy, Culture, Sports, etc., **Socio-economic problems of Bangladesh:** **Bangladesh:** poverty, health issues, natural disaster, social stratification and social mobility.

References

1. Islam, S. (2003). Banglapedia. National Encyclopedia, Asiatic Society, Dhaka
2. Kibria, S. A. (1999). *Bangladesh at the Crossroads*. University Press, Dhaka
3. Riaz, A. (2016). Bangladesh: A Political History since Independence. Dhaka: Dhaka University Press.

Course Name: Combinatorial Optimization

Code: CSE 301

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

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

References:

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

Course Title: Numerical Analysis for Engineers

Code: MATH 304

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

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

References:

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

Course Title: Software Project Lab I

Code: SE 305

Credit: 3 Credits (3 Credit Theory)

Course Outline: Each of the students should complete the software project and be marked based on their individual software. Student will be encouraged to complete the project requires significant “problem solving” effort. The project should be sufficient to demonstrate the skills of the project will mostly depend on “problem solving” effort. Besides, student should demonstrate the skills they have acquired from their so far completed courses.

Course Title: Object Oriented Concepts II

Code: SE 306

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Object Oriented Concepts - Review of Object Oriented Concepts, Object Behaviors, Class, Attributes, Methods, Encapsulation and Data Abstraction, Implementations, Inheritance: Super classes and Sub classes, Abstract Classes, Polymorphism, Compositions: Abstractions and Has-A Relationship; Modeling Objects – Building Objects – Representing Composition with UML, Composition and Aggregation Phases, Types of Composition: Aggregation and Associations, Association Cardinality; Details of Creating Object Models with UML – Class Diagrams, Methods, Access Designations, Inheritance, Interfaces, Composition, Associations, and Cardinality; Objects and Portable Data - Portable Data Format Language (XML), XML Versus HTML, XML and Object-Oriented Languages, Document with the Document Type Definition (DTD), Integrating XML with a Document, and Using Cascading Style Sheets; Persistence objects – Basic Persistence to a Flat File, Using XML in the Serialization Process and Writing to and Reading from Objects and the Internet – Object-Based Scripting Languages, Object-Oriented Distributed Objects and the Enterprise; Objects and Client/Server Applications – Approaches, Proprietary Approaches and Nonproprietary Approaches; Design Principles - Single Responsibility Principle, Open/Close Principle, Liskov Substitution Principle, Interface Segregation Principle and Dependency Inversion Principle; Inheritance-Based Design, Design Patterns and Code Smells. **Programming in Java** - Object-Oriented Programming (OOP) - The students will implement each of the object oriented concepts discussed in the class. Java features to support practical OOP – Generic Collections: Generic definitions, Generic method definitions, Using generics; Collection Framework: interfaces, List and SortedList, Map and SortedMap, Navigable Map, Set and TreeSet, Queue and DeQueue, Stack, hashCode() and equals(), Comparable and Comparator, Reflection: The *Class* Class, reflect package, Fields and Methods, Annotations, Reflections and Dynamic Programming; Multi-Threaded Programming: Thread Model, Creating and Running Thread, Thread Pools, Thread Synchronization: notify, join and sleep and The concurrency API; User Interface: Swing Components: Events, Layouts and SwingWorker; Serialization: Serializable interface, Externalizable, Object, Handling Exceptions, Customized Serialization and Controlling Serialization; Networking: Programming: Clients and Servers, Ports, Addresses and Protocols, Client-Server Architecture, Servers, The *ServerSocket* Class, The *URLConnection* Class and *URLConnection* Class; Web Programming: Introduction To Servlet, Servlet Life cycle, *HttpServlet*, *HttpServlet* Methods, *RequestDispatcher*, *HttpSession* and *ServletContext*, Servlet Configuration and *Http* Headers and MIME types; The Java Beans API: *Introspector*, *PropertyDescriptor* 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: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction: Overview of the Internet, Overview of Network Edge, Network Core, Protocol Layers / Service Model, Generalized Network Architecture; Application Layer: Principles of Networking Applications, Web and HTTP; Transport Layer: Transport Layer Services, Multiplexing and Demultiplexing; Transport: UDP, Principles of Reliable Data Transport, Connection-Oriented Transport: TCP, Principles of Congestion Control, TCP Congestion Control; Network Layer: Inside a Router, Details of the Internet Protocol (IP), IP Subnetting, IP Routing (Static, State, Distance Vector), Routing in the Internet (Routing Information Protocol, 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 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Brief Review of mathematical background: Binary strings, languages, proofs, inductive definitions; Finite automata and regular expressions; non-deterministic finite automata, regular expressions and regular languages; Properties of regular sets: pumping lemma, closure properties, decision problems; Context-free grammar and languages: Context-free grammars, regular grammars; Simple grammars: useful symbols, productions, unit productions, chomsky normal form; 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, Rajeev Motwani, Jeffrey D. Ullman, Third Edition, Pearson Education

Course Title: Operating System and System Programming

Course Code: CSE 401

Course Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction: What is operating system? History of operating system concepts Operating system structure Processes and Threads Process communication Scheduling Classical IPC problems Memory Management Virtual memory Page replacement algorithms Design issues for paging issues File Systems Files Directories File system management Input / output hardware Principles of I/O software I/O software layers Disks Clock 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 Title: Business Psychology

Code: GE 402

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline:

Fundamentals: Definition of Psychology, Subfields of Psychology, Psychology, Psychology in Business; Job Analysis: Job-oriented Approach, Purposes of Job Analysis, Methods of Job Analysis, Job Methods for Selection and Placement: Psychological Tests: Ability Intelligence Test, Vocational Interest Test; Training and Development: Training Designs, Training Methods, Evaluation of Training; Theories Need Theories, Reinforcement Theory, Expectancy Theory, Goal Setting Emotion: Nature of Job Satisfaction, Assessment of Job Satisfaction, Potential Effects of Job Satisfaction, Organizational Communication Productive and Counterproductive Employee Behavior: Productive Behavior Counterproductive Behavior, Withdrawal, Aggression, Mistreatment Occupational Health Psychology: Occupational Health and Safety, Work Stress, Work-Family Conflict, Burnout, Hawthorne Studies; Leadership Understanding of Leadership Trait Approach, Leader Behavior Approach Path-Goal Theory, Leader-Member Exchange (LMX) Theory, Transactional Theory; Organizational Development and Theory: Organizational Acceptance of Change, Management by Objectives, Survey Feedback, Effectiveness of Organizational Development: Organizational Theories, Theory Y, Open System Theory, Socio-technical System Theory.

References:

1. Industrial and Organizational Psychology: Research and Practice, 4th Edition

Course Title: Database Management System I
Code: CSE 404
Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

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

References:

1. Database System Concepts by Avi Silberschatz, Henry F. Korth, 6th Edition

Course Title: Business Studies for Engineers
Code: CSE 405
Credit: 3 Credits (3 Credit Theory)

Course Outline: Managers and Entrepreneurs: Management Definition, Management Functions, Small-Business Management, The Evolution of Management Thought, 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 Basics:** Business Organization, Types of Activities performed by Business Organization, Business Organization, The Accounting Equation, The Account and Rule of Debit and Credit, Journal: Recording of Transaction, Adjusting the Accounts, Closing Entries, Preparation of Financial statements from the Work Sheet. **Analysis and Interpretation of Financial Statements:** Objectives of Financial Statement Analysis, Analysis of a Balance Sheet, Income Statement, Income and Retained Earnings, Ratio Analysis: Liquidity Ratios, Equity Ratios, Profitability Test, Market Test.

References:

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

Course Title: Software Requirements Specification and Analysis
Code: SE 406
Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Review of – The Nature of Software, Software Engineering Process, Software Engineering Practices, Generic Software Process Model, Software Process Improvement, Prescriptive Process Models, Specialized Process Models, Requirements Engineering, Establishing the ground work, Eliciting Requirements, Validating Requirements, Requirements Analysis, Scenario Based Modeling, Models, Data Modeling Concept, Class Based Modeling, Requirements Modeling, Object-Oriented Model, Behavioral Model, Requirements Modeling for Web Applications.

Lab: One small real life system will be given to all the students for an analysis. Three real life mid-scale systems will be distributed among groups (3-4 students to analyze (one project per group). The output of both of the analysis will be reports.

References:

1. R. S. Pressman, Software Engineering. A Practitioner's Approach, Addison-Wesley, Reading, MA, 1986.
2. Ian Sommerville. Software Engineering, 9th or higher Edition, Addison-Wesley, Reading, MA, 2004.

Course Title: Information Security

Code: CSE 411

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Overview: Network Security Concepts, Security Mechanisms; Classical Encryption techniques: Symmetric Cipher: Caesar Cipher, Vigenere Cipher, Hill Cipher; Block Ciphers: DES, AES; Steganography; Block Ciphers and Data Encryption: principles and modes of operation; Public-key cryptography: Introduction to RSA, Diffie-Hellman; Message Digest: Requirements for cryptographic hash functions, SHA-1, SHA-256; Message authentication codes, digital signatures; Key Management and Key Distribution using Symmetric Encryption, Symmetric Key Distribution; Public Key Encryption, public key distribution, public key certificates, x.509 certificates; Network Security: Transport Layer Security, Wireless LAN security, e-mail security.

References:

1. Information Security: Principles and Practice by Mark Stamp 2nd Edition, Addison-Wesley, Reading, MA, 2004.

Course Title: Web Technology

Code: CSE 502

Credit: 3 Credits (1 Credit Theory and 2 Credit Lab)

Course Outline: Introduction To Html, Java Script & CSS, Server Side Scripting, Web Server, Application Server, MVC Web Framework, Web Services, XML, XSL, Relational Mapping, Lambda Expression, Language Integrated Query, IIS, Web Security: Denial of Service, Buffer Overflow, Cross Site Scripting, Access Control

References:

1. Deitel & Deitel, Goldberg, "Internet and world wide web – History and Technology", Education Asia, 2001.
2. Rajkamal, "Web Technology", Tata McGraw-Hill, 2001.
3. Teach yourself web technologies part I & II- I. Bayross. BPB
4. Web Design in a Nutshell- J. Niederst, SPD

Course Title: Business Communications

Code: BUS 503

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Outline: Communication Concept: The Role of Communication in Business, Communication Skills, Main Form of Business Communication. **Fundamentals of Business Writing:** Adaptation and Construction of Clear Sentences and Paragraphs, Writing for Effect. **Business Messages:** Directness in Good News and Neutral Situations, Indirectness in Persuasion Message, Letter and Memorandum, Letter Variations in Memorandums and the Email, Job Search Activities: Strides in the Process, Job search activities, Writing CV, Facing Interviews, Feedback. **Fundamentals of Report Writing:** Basics of Report Writing, Report Structure and Formal Report, Usages of Graphics. **Other Form of Business Communication:** Communication, Technology-Enabled Communication.

References:

1. Raymond V. Lesikar, John D. Pettit, Maire E. Flatley, Lesikar's Business Communication, Mc Graw Hill

Course Title: Database Management System II Code: CSE 504 Credit: 3 Credits (1 Credit Theory and 2 Credit Lab)

Outline: Indexing and Hashing: Basic Concepts, Ordered Indices, B+-Index Files, Static Hashing, Dynamic Hashing, Comparison of Ordered and unordered Indexing; Query Processing: Overview, Measures of Query Cost, Selection Operation, Evaluation of Expressions; Query Optimization: Introduction to Relational Expressions, Catalog Information for Cost Estimation, Statistical Estimation, Cost-based optimization; Transactions: Transaction Concepts, Concurrent Executions, Serializability; Concurrency Control: Lock-Based Protocols; Recovery System: Failure Classification, Storage Consistency, Atomicity, Log-Based Recovery, Recovery With Concurrent Transactions; Data Mining: Data Mining, Decision tree, Bayes theory, Randomized Algorithms; Architectures: Centralized and Client-Server Systems, Server System Architectures, Distributed Systems, Network Types; Parallel Databases: Introduction to Parallelism, Interquery Parallelism, Intraquery Parallelism, Intraoperation Parallelism; Distributed Databases: Heterogeneous and Homogeneous Distributed Databases, Storage, Distributed Transactions, Commit Protocols; Additional should include Database Design, Database Tuning Security and Authorization, Multidimensional query processing.

References:

1. Ramez Elmasri and Shamkant B. Navathe Fundamentals of Database Systems, Sixth Edition. Addison-Wesley Pub Co, 1999.
2. Database Systems: The Complete Book, Hector Garcia-Molina, Jennifer D. Widom Prentice Hall. (best supporting book)
3. Fundamentals of Database Systems, by Ramez Elmasri and Shamkant B. Navathe, Addison-Wesley.
4. Database System Concepts, Fifth Edition, Avi Silberschatz, Henry F. Korth, Pearson Education, Inc.

Course Title: Software Project Lab II Course Code: SE 505 Credit: 3 Credits (3 Credit Theory)
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Course Outline: Students will create project teams of 3 members each. The project can be varied for special cases, decided by the assigned course manager. Students are required to prepare their Software Requirements Specification (SRS) for the project accordingly.

Course Name: Design Patterns

Code: SE 506

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Revision of Concepts of OOP, Importance of learning Design Patterns - Structural, Behavioral and Creational Patterns, Creation Factory, Factory Method, Abstract Factory, Builder, Prototype and Object - Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Method Template Method, Visitor and Null Object, Structural Patterns – Adapter, Decorator, Flyweight and Proxy, REFACTORING CODE SMELL, Difficult Inappropriate Naming, Comments, Dead Code, Duplicated code, Primitive Lazy Class, Alternative Class with Different Interface, Long Method, Long Statements, Speculative Generality, Oddball Solution, Feature Envy, Refactor and Train Wreck, Design Principles (SOLID) - Single responsibility Principle, Liskov substitution principle, Interface segregation principle principle.

References:

1. Gamma, Erich. *Design patterns: elements of reusable object-oriented Education*, 1995.

Course Title: Professional Ethics for Information Systems

Code: SE 511

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction to Ethics, Morals, Integrity, Ethical use of Ethics for IT Workers and IT Users - Trade secret, Whistle blowing, bribery, professional code of ethics, IT professional malpractice and Computer users, Computer and Internet Crime - Exploit, Viruses, Phishing and Typing - Information privacy, fair information practices, EU data protection of anonymity issues, Freedom of Expression - Right to freedom of expression speech, defamation, controlling access to information on the internet, a corporate blogging and pornography, Intellectual property - Copyright, software patents, trade secret and key intellectual property issues, Impact networking ethical issues, Ethics for IT organization.

References:

1. Ethics In Information Technology, George W. Reynolds

Course Title: Distributed Systems

Code: CSE 601

Credit: 3 Credits (1 Credit Theory and 2 Credit Lab)

Course Outline: Foundations - Characterization of DS, System Models, Internetworking, Interprocess Communication, Remote Invocation, Indirect Operating System Support **Middleware** - Dist. Objects and Components, Peer-to-Peer Systems System services – Security, Distributed File Systems, Distributed algorithms - Time and Global States, Coordination and Transactions and Concurrency Control, Distributed Transactions, and Replication Mobile and Ubiquitous Computing

Lab: Introduction to Message passing technology and its applications, Remote Procedure Calls code implementation, Synchronization, Communication code implementation, Distributed mutual exclusion algorithms, Election Algorithms, Implementation of Distributed File system: MapReduce Systems Design assignments: Cloud Services and Content Delivery Networks

References:

1. Distributed Systems: Concepts and Design (5th Edition). Gordon Bell, Jean Dollimore (Author), Tim Kindberg (Author), Gordon Bell (Author)

Course Title: Artificial Intelligence

Code: CSE 604

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Intelligent Agents and their Environments - The concept of an agent, Specifying the Task environment (PEAS description), Different characteristics of agents (Fully vs Partially observable, Static vs Dynamic, Episodic vs Sequential), Types of agents (Reflex, Goal-based, Utility-based etc.), Search - Formulation of search problems, Uninformed Search strategies: BFS, DFS, DLS, ID-DFS, their working principles, relative advantages and disadvantages, Informed (heuristic) Search strategies: Greedy search, A* search: Working principle, Characteristics of heuristics (admissibility, consistency), Proof of A*'s optimality, Local search: Hill Climbing, Searching with AND-OR search trees and Searching with partial observability: Beam Search, Adversarial Search - Formulation of a Game tree, The minimax algorithm: rationale, working principle and Additional techniques such as Move ordering, Probabilistic Reasoning - Bayes' rule and its uses, Bayesian Network: Formulation, making inference from it, Markov Chains and Hidden Markov Models: Formulation, models, Building and HMM, applications of HMM, Inference in temporal models: Prediction, Most Likely explanations (Viterbi algorithm) etc. and Partially Observable Markov Decision Processes: Formulation, Working principle, Making Decisions - Decision theory and Utility theory: Formulation, Maximum Expected Utility principle, Constraints of Utility (Orderability, Transitivity), Markov Decision Processes: Policies, Rewards, Optimal policies and their computation: Iteration, Supervised Learning - Basic concepts of classification and supervised learning: Training set, Test set, Overfitting, Underfitting etc., Decision trees: Basic understanding, Pruning, Decision tree through entropy calculation, Nearest Neighbor classifier:

Relative advantages and disadvantages, Naive Bayes classifier: Basic working principle, Calculating classification procedures, Relative advantages and disadvantages, Neural Network: Basic working principle, Basic structure and calculation of weights, backpropagation algorithm and Support Vector Machines: Basic working principle, Learning (Clustering) - Basic concepts and applications of Clustering, Different types: Partitional vs. Hierarchical, Exclusive vs Overlapping vs Fuzzy, Comparison of Clustering: Basic working principle, characteristics, advantages, disadvantages, Hierarchical Clustering: Basic concepts, Representations (Dendrograms, Heatmaps, diagrams), Different techniques to define cluster proximity: Single linkage, Ward's average, Centroid method, their relative advantages and disadvantages, K-Means: Basic principle and applications, Classification of points (Core, Border and Noise points), Reinforcement Learning - Understanding basics of Reinforcement Learning: MDPs, POMDPs, etc., Passive and Active Reinforcement Learning, Exploration and Exploitation, Deep Reinforcement Learning, Programming, Temporal Difference Learning and Q-Learning.

References:

1. Russell, Stuart, and Peter Norvig. "Artificial intelligence: a modern approach." Prentice Hall, 2003.

Course Title: Software Testing and Quality Assurance

Course Code: SE 605

Course Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: The Psychology and Economics of Software Testing, Software Testing Process (STLC), Software Testing Terminology and Methodology, V&V Models, Software Testing – Boundary Value Analysis, Equivalence Partitioning, State Transition Testing, Decision Table based Testing, Cause-Effect Graphing based Testing and Error Guessing, White Box Testing – Basis Path Testing, Data Flow Testing and Mutation Testing, Walkthroughs, Technical Reviews, Unit Testing, Integration Testing, System Testing, Acceptance Testing, Regression Testing, Test Management – Test Planning, Test Design and Specifications, Software Metrics, Software Quality, Quality Assurance, Quality Management and Project Management, Software Testing for Internet Applications - Security and Performance Testing, Debugging, Test Driven Development (TDD), Behavior Driven Development (BDD). **Tools and Project** - The students will be divided into small groups having at most 3 members and a class project will be given to each group. They will develop a system test case. They must validate the requirements and create Mock objects and write test cases. Besides, each of the students will relate their learning to real world performance and security testing, debugging, behavior driven development, Test Driven Development (TDD), Behavior Driven Development (BDD), JUnit, Selenium, Apache JMeter, Sprajax, Sqlninja, Bugzilla, Cucumber.

References:

1. Naresh Chauhan, Software Testing: Principles and Practices, 1st Edition, Alpha University Press.
2. Glenford J. Myers, Corey Sandler, and Tom Badgett. The Art of Software Testing, 3rd higher Edition, John Wiley & Sons.
3. Lisa Crispin and Janet Gregory. Agile Testing: A Practical Guide for Teams, 1st or higher Edition, Pearson Education.

Course Title: Software Design and Analysis

Code: SE 606

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Design Concept - The Design Process, Design Concepts, Architectural Design: Software Architecture, Architectural Genre, Architectural Design, Assessing, Alternative Architectural Designs, Architectural Data Flow; Component-Level Design: What Is a Component, Designing Components, Conducting Component-Level Design, Component-Level Design for Traditional Components, Component-Based Development; User Interface Design: Rules, User Interface Analysis and Design, Interface Analysis, Interface Design, Design Evaluation.

References:

1. Software Engineering – A Practitioner’s Approach. 7th Edition, R. S. Sedgwick
2. Software Engineering. 9th Edition, Ian Sommerville

Course Title: Software Metrics

Course Code: SE 611

Course Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Overview of Software Metrics, The basics of Metrics, Metrics framework for software measurement, Empirical Investigation, Measuring Software Metrics, Measuring Internal Attributes : Structure, Measuring Cost and Effort, Measuring External attributes : Quality, Measuring Software Reliability, Object Oriented Metrics, Metrics experiences: Students will implement different software metrics calculations, utilize existing industry related tools for measuring software metrics and their implementations to gain concrete idea.

References:

1. Software metrics- A Rigorous and Practical Approach, (3rd Edition) by R. S. Sedgwick, Jones Bieman.
2. Software Measurement and Estimation: A practical Approach (1st Edition) by R. S. Sedgwick and M. Carol Brennan

Course Title: Software Security

Course Code: SE 612

Course Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction: Security principles, concept of computer security, security and policies Security risks: Database security, operating systems security, Network security Countermeasures: methodologies and tools for identifying and eliminating security risks, techniques to prove the absence of vulnerabilities, and ways to avoid security risks in software. Secure software design: essential guidelines for building secure software, security standards.

Suggested Readings:

1. Security in Computing, 4th Edition, by Charles P. Pfleeger, Prentice Hall

2. Computer security: principles and practices, William Stallings, 2nd Edition
3. Brian Chess and Jacob West, Secure Programming with Static Analysis
4. David A. Wheeler, Secure Programming for Linux and Unix Hosts, 2004 (required)
5. Goertzel et al, Software Security Assurance State of the Art Report
6. Aleph One, Smashing the Stack for Fun and Profit. Phrack Vol 7, Issue 9
7. Tim Newsham, Format String Attacks, Guardent tech report, September 1996

Semester 7 (4th year 1st Semester)

Course Title: Internship

Code: SE 701

Credit: 18 Credits (18 Credit Lab)

Outline: The student will work full-time as an intern to particular company for 6 months. S/he will be evaluated based on the marks provided by the company at the end of at least two presentations given at IIT.

Course Title: Project

Code: SE 801

Credit: 6 Credits (6 Credit Lab)

Outline: Each student can perform a software development or research project a student has to submit a thesis. For software development project documents having the following: Project proposal, Software Requirements Design Specification, Software Test Plan and User Manual. Besides, each student give multiple intermediate presentations to report their project progress.

Course Title: Software Project Management

Code: SE 803

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction to Project management: Historical background, Terminologies, Software project management objectives, Scope, focus and boundaries of software project management: Basic PM Skills, SPM framework, boundaries, challenges of SPM Software Project planning: Planning variations, structure of SPM plan, project estimation, estimation methods, process. PM organization and scheduling: WBS, types of WBS, functions, cycles, phasing and purpose of phasing, building project schedule, network diagrams, Bar charts, Gantt charts Software project management techniques: Use of risks and issues, Managing Quality, Configuration, Change, Crisis, Documentation, monitoring and control: Dimensions of monitoring and control, earned value management (CV, SV, CPI, SPI), backlog management, dispute and error tracking, project scenarios: Domain analysis, Business case analysis, Dynamicity, Success factors, case studies

References:

1. Stellman, Andrew, and Jennifer Greene. *Applied software project management*. Media, Inc.", 2005.
2. Phillips, Joseph. *IT project management: on track from start to finish*. 2002.
3. Rubin, Kenneth S. *Essential Scrum: A practical guide to the most productive agile process*. Addison-Wesley, 2012.

Course Title: Software Maintenance

Code: SE 811

Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Lifecycle roadmap is presented and different types of errors and activities are placed on it. Status within industry and research is mapped and discussed and analyses in different contexts (the traditional, component-based, Pre delivery and transition maintenance models are studied and criteria are identified. Impact analysis is studied. Different ways to manage customer requirements

both the critical (emergency) and non-critical ones. Retirement process. Finally, the quality attribute "maintainability" is discussed and compared. Techniques for evolutionary design in the small: refactoring. Test-driven evolutionary design, especially evolution of legacy systems. Architectural isolation/exposure of change.

References:

1. Effective Software Maintenance and Evolution: A Reuse-Based Approach By Robert Jarzabek; Publisher Taylor & Francis
2. Software Maintenance: Concepts and Practice By Penny Grubb, Aileen Grubb; 2nd edition World Scientific USA.

Elective Courses

Course Title: Computer, Data and Network Security
Code: CSE 802
Credit: 2 Credit Theory and 1 Credit Lab

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

References:

1. Data and Computer Communications By Stallings, 8th Edition, Pearson

Course Title: Data Mining and Warehousing
Code: CSE 825
Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction to Data Mining, Knowing Data (Data dissimilarities, statistical descriptions and visualizations), Data Pre-processing and Online Analytical Processing, Data Cube technology, Mining frequent and Cluster Analysis, Research trends in Data mining and warehousing.

References:

1. Data Mining: Concepts and Techniques. Jiawei Han, Micheline Kamber [Book]

Course Title: Pattern Recognition and Image Processing
Course Code: CSE 829
Course Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction to Image Processing; Digital Image Fundamentals; Visual Perception. Light and the Electromagnetic Spectrum. Image Sensing; Sampling and Quantization. Some Basic Relationships between Pixels; Operations; Image Enhancement in the Spatial Domain - Background. Transformations. Histogram Processing. Enhancement Using Arithmetic of Spatial Filtering. Smoothing Spatial Filters. Sharpening Spatial Filters. Enhancement Methods; Image Enhancement in the Frequency Domain - Introduction to the Fourier Transform and the Frequency Domain. Smoothing Filters. Sharpening Frequency Domain Filters. Homomorphic Filtering. Implementation - A Model of the Image Degradation/Restoration Process. Noise Model. Presence of Noise Only-Spatial Filtering. Periodic Noise Reduction

Filtering. Linear, Position-Invariant Degradations. Estimating the Degradation. Wiener Filtering. Minimum Mean Square Error (Wiener) Filtering. Constrained Least Squares Filtering. Geometric Mean Filter. Geometric Transformations; Color Image Processing. Color Models. Pseudo color Image Processing. Basics of Full-Color Image Processing. Color Transformations. Smoothing and Sharpening. Color Segmentation. Noise Removal. Image Compression; Wavelets and Multiresolution Processing - Background. Wavelet Expansions. Wavelet Transforms in One Dimension. The Fast Wavelet Transform. Wavelet Transforms in Two Dimensions. Wavelet Packets; Image Compression. Compression Models. Elements of Information Theory. Error-Feedback Image Compression. Image Compression Standards; Morphological Image Processing. Dilation and Erosion. Opening and Closing. The Hit-or-Miss Transform. Morphological Algorithms. Extensions to Gray-Scale Images; Image Segmentation. Discontinuities. Edge Linking and Boundary Detection. Thresholding. Region Labeling. Segmentation by Morphological Watersheds. The Use of Motion in Segmentation. Image and Description - Representation. Boundary Descriptors. Regional Descriptors. Feature Components for Description. Relational Descriptors; Object Recognition. Object Classes. Recognition Based on Decision-Theoretic Methods. Structural Models.

References:

1. Digital Image Processing - Rafael C Gonzalez and Richard E. Woods

Course Title: Computer Graphics and Multimedia

Course Code: CSE 831

Course Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Introduction: History of computer graphics, graphics applications, computer imaging: pinhole camera, human vision, synthetic camera, modeling and rendering, architecture, displaying simple two-dimensional geometric objects, position and color in a windowed environment Color: Color perception, color models (RGB, CMYK, HSV), color transformations. Color in OpenGL. RGB and Indexed color. Input and output in a windowed environment, client-server computing; input measure, event, sample and callbacks, picking. Geometric transformations: affine transformations (translation, rotation and shear), homogeneous coordinates, concatenation, current transformation matrix. Three dimensional graphics: classical three dimensional viewing, projection, transformation in 3D, projective transformations. Ray Tracing. Shading: hidden surface modeling, Phong shading model, polygon shading. Rasterization: line and polygon clipping, scanline algorithm, clipping, polygonal fill, BitBlt. Introduction to hidden surface removal. Discrete Techniques: buffers, bitblt, reading and writing bitmaps and pixel operations, compositing.

References:

1. Computer Graphics, Principle and Practices – James D. Foley, Andries van Dam, Steven K. Van Dam, John F. Hughes.

Course Title: Information Retrieval
Code: CSE 840
Credit: 3 Credits (2 Credit Theory and 1 Credit Lab)

Course Outline: Boolean Retrieval: Inverted Index, Processing boolean retrieval; Term Vocabulary and Postings lists: Document delineation decoding, Tokenization, Dropping common terms: stop words, Normalization of terms), Stemming and lemmatization, skip pointers, Biword indices, Dictionaries and tolerant retrieval: Search structures for dictionaries, Grammar indexes for wildcard queries, Spelling correction; Index Construction: indexing, Single-pass in-memory indexing, Distributed indexing, Dynamic Ranking: Parametric and zone indexes, Term frequency and weighting, Term scoring, variant tf-idf functions; Computing scores in a complete search and ranking, Components of an information retrieval system; Evaluation: Evaluation of unranked retrieval sets, Evaluation of ranked retrieval results, Results snippets; Relevance feedback and query expansion: The Rocchio feedback, Relevance feedback on the web, Evaluation of relevance feedback methods for query reformulation; Language models for information retrieval; Information Retrieval: Explore the capacity of Apache Lucene as a text search engine.

References:

1. An Introduction to Information Retrieval by Christopher D. Manning, Hinrich Schütze, Online Edition, 2009, Cambridge University Press
2. Lucene in Action by Michael McCandless, Erik Hatcher, and Otis Flanagan, 2nd Edition, Manning publications.

Course Title: Strategic Management
Code: BUS 842
Credit: 3 Credits (3 Credit Theory)

Course Outline: Strategic Management Concept: Strategic Leadership, Superior Performance, Performance in Nonprofit Enterprises, Strategic Management Process. **Industry analysis, External Environment and Internal Resources:** Industry and Sector, market segments, Porter's Five Forces Model, Strategic Group Analysis, Macroeconomic Forces, Competitive Advantage, Value Chain, Avoiding Failures and Sustaining Competitive Advantage. **Functional Strategy:** Achieving Superior Efficiency, Learning Effects, Materials Management, Attaining superior Reliability, Responsiveness to Customers, Competitive Level Strategy, Strategies in Fragmented Industries, Embryonic, Growth Strategies. **Technological Support for Adopting Strategies and Global Strategy:** Winning in Format War, Information System Strategy, Managing Internationalization, Capturing First-Mover Advantages, Technological Paradigm Shifts, Profitability and Profit Growth through Global Expansion, Globalization. **Strategic Software Engineering:** Architecture-Centric Software Development, Product Lines, Software Effort and Cost Estimation Strategies, Openness in Supply Chain, Software Economics.

References:

1. Theory of Strategic Management (Eighth Edition) By: Hill/Jones
2. Strategic Management (Concepts and Cases) Twelfth Edition By: Hill/Jones

Course Title: Applied Data Science Course Code: CSE 844 Course Credit: 2 Credits Theory and 1 Credit Lab

Course Outline:

Theory: Introduction to applied data science, Data cleaning/Data Publication techniques, Predictive analytics, Bayesian analytics, Building efficient models, Regularization, Opportunities involving applied data science. The course covers collecting, storing, and analyzing data in varying formats. Scientific projects, supervised and unsupervised analytics and data visualization techniques will be covered. Topics include: linear learning classifiers, Bayesian, maximum a posteriori, parameter estimation, neural networks, support vector machines, bag of words classifiers, N-gram models, nearest neighbor classifiers, locally weighted regression, ensemble classification models, k-means clustering, hierarchical clustering, distributional clustering, applications in data mining, automated knowledge acquisition, pattern recognition, natural language processing, internet-based information systems, etc.

Lab: The course lab aims to provide an introduction to various topics including Data Discovery, Data Visualization, along with a toolkit to use with data i.e., Hadoop.

References:

1. Mount and Zumel (2014), Practical data science with R.
 2. Cathy O'Neil and Rachel Schutt, *Doing Data Science*, O'Reilly, 2015.
 3. Russell Jurney, *Agile Data Science*, O'Reilly, 2013.
 4. Edward Tufte, *The Visual Display of Quantitative Information*, (2nd edition).
 5. Morgan Kaufmann, *Data Mining: Practical Machine Learning Applications*, 2nd edition, 2011
 6. Matthew Russell, *Mining the Social Web: Data Mining Facebook, Google+, GitHub, and More*. O'Reilly, 2013
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INSTRUCTIONS FOR PAPER-SETTERS

(Approved under A.C.M. 3-12-37)

1. No question shall be set at any examination which may require an expression of religious belief on the part of candidates.
2. Examiners setting papers shall be guided, as to the scope of the subjects of examination, by the syllabus prescribed and as to the standard and extent of knowledge required, by the books, if any, recommended by the University from time to time for such purpose.
3. The paper set shall be such as candidates can reasonably be expected to answer within the time allotted. The question in each subject shall be fairly distributed over the whole course in that subject, and shall conform to the regulation laid down for the particular examination. Examiners shall allow some choice questions to candidates.
4. Examiners shall as far as practicable, avoid any marked change of standard from year to year, but shall not be required to set the same type of questions every year.
5. Examiners shall set questions which are within the capacity of the candidates, but shall so frame them that there shall be no ambiguity as to their meaning and that they cannot be answered by unintelligent memorising.

The Paper-setter is particularly requested

1. To take special care in writing proper names and technical words
2. To set questions for Honours and Master's Degree Examinations in such a way that originality and individuality of the candidate may be encouraged.
3. To make sure that the manuscripts of questions are as clear and legible as possible so as to ensure accuracy in printing.
4. To give at the bottom of the question paper, in case of quotations and extracts, full reference to the text books or other books from which they are taken indicating the edition used and the page on which they occur.
5. To destroy any copy of the question papers framed by and all rough drafts and memoranda connected therewith.
6. To initial all corrections without exception.
7. To sign at the bottom of each sheet of his question paper in the place indicated.

Sd/-
Controller of Examinations
UNIVERSITY OF DHAKA

N.B. :—If any paper-setter fails to send his question paper by the date fixed for the purpose, the University shall have the right to appoint another Examiner in his place without further notice.

(পরীক্ষার কল প্রকাশের এক মাসের মধ্যে নিম্নিষ্ট বিভাগীয় পরীক্ষা পরিষদের সভাপতির মাধ্যমে পরীক্ষা নিয়ন্ত্রকের অফিসে, পাবনাশিক্ষকের বিন পেশ করিতে হইবে)।

পদবী সহকারে চিহ্নিত।

(১) প্রশ্নপত্র প্রণয়ন :	(ক) একটি পূর্ণ/অর্ধপত্র	পরীক্ষার	বিষয়	পত্র/কোর্স
(খ)	১১ ১১ ১১ ১১	১১	১১	১১
(গ)	১১ ১১ ১১ ১১	১১	১১	১১

(৩) উক্তপত্র প্রত্যয়ন করা : (ক).....পূর্ব/অর্থ বাড়া.....পরীকার.....বিষয়.....পত্র/কাগজ
 (খ)....." " " " " " " " " "
 (গ)....." " " " " " " " " "

(৬) পরীক্ষার কল সমিতিবৈশিষ্ট্য: ২০..... সনের বিষয়ে
পরীক্ষার জন পরীক্ষার্থীর জন্য

(৮) ডাক মাস্তুল ও সংশ্লিষ্ট অন্যান্য বিবিধ খরচ :-
(ডাক মাস্তুলের এবং সংশ্লিষ্ট অন্যান্য বিবিধ ধরনের রশিদ বিলের সহিত সংশ্লিষ্ট না থাকিলে উহা পরিশোধযোগ্য বলিয়া গণ্য হইবে না)।
বি: দ্র:-৮ নং ক্রমানুসারে বিবিধ ধরনের ডাকচার (পোস্টাল রশিদ ও কার্পনমেনো) এর মাধ্যমে পরীক্ষকের স্বাক্ষর থাকা প্রয়োজন ন।

বোট টাকা

वर्तमान ठिकाना

(কথায়)
 যাইতে পারে।

• **श्रीकृष्ण**

পরীক্ষা উপ-নিয়ন্ত্রক
ঢাকা বিশ্ববিদ্যালয়।

বিঃ দ্রঃ-(ক) ২০০'০০ টাকার ঊর্ধ্বে দাবী রাজস্ব টিকিট বাতিল পরিশোধ করা বাইবে না।
(খ) পরীক্ষক সরকারী চাকুরিরা হইলে স্বাধায কর্মকর্তার অনুমতি ব্যতিরেকে দাবী পরিশোধ করা হইবে না।

