Proposed Syllabus for M.Sc. in

Computer Science Applications

Two-Year Four-Semester PG Course

with specialisation in

A. **Cyber Security and Forensic**

B. **Business Data Analytics**

Proposed Curriculum

Grand Total Marks – 1000 **Total Credits - 100**

1st SEMESTER

SL. No.	Subject	Theory	Internal Assessment	Credit	Code
1.	Digital Systems	40	10	5	CSA/ThG/101
2.	Programming & Data Structure	40	10	5	CSA/ThG/102
3.	Discrete Mathematics	40	10	5	CSA/ThG/103
4.	Probability & Statistics	40	10	5	CSA/ThG/104
5.	Lab I (Programming & Data Structure)	40	10	5	CSA/LG/105
		200	50	25	

2nd SEMESTER

SL. No.	Subject	Theory	Internal Assessment	Credit	Code
1.	Design & Analysis of Algorithm	40	10	5	CSA/ThG/201
2.	Software Engineering	40	10	5	CSA/ThG/202
3.	Database Management System	40	10	5	CSA/ThG/203
4.	Lab II (Statistical Tools & Object Oriented Programming Lab.)	40	10	5	CSA/LG/204
5.	Lab III (Database Management System)	40	10	5	CSA/LG/205
		200	50	25	

3rd SEMESTER

Sl. No.	Subject	Theory	Internal Assessment	Credit	Code
1.	Operating System & System Software	40	10	5	CSA/ThG/301
2.	Computer Networks	40	10	5	CSA/ThG/302
3.	Special Paper-I (Information Security/Data Mining)	40	10	5	CSA/ThS/303
4.	Computer Networks Lab.	40	10	5	CSA/LG/304
5.	Project Preliminary	40	10	5	CSA/PP/305
		200	50	25	

4th SEMESTER

SL. No.	Subject	Theory	Internal Assessment	Credit	Code
1.	Internet Technology	40	10	5	CSA/ThG/401
2.	Special Paper II (Cryptography & Network Security/Machine Learning)	40	10	5	CSA/ThS/402
3.	Special Paper III (Cybercrime & Forensics/ Big Data Analytics)	40	10	5	CSA/ThS/403
4.	Lab on Special Papers	40	10	5	CSA/LS/404
5.	Project Final	40	10	5	CSA/PF/405
		200	50	25	

ThG: Theory (General)

ThS: Theory (Special)

LG: Laboratory (General)

LS: Laboratory (Special)

PP: Project Preliminary

PF: Project Final

Based on the Specialization, the students will be required to take the following group of subjects as shown in the curriculum

A) Cyber Security & Forensics

1. Information Security
2. Cryptography & Network Security
3. Cybercrime & Forensics

B) Business Data Analytics

1. Data Mining
2. Machine Learning
3. Big Data Analytics

First Semester

Paper Code: CSA/ThG/101
Digital Systems

Digital Logic
Introduction to Digital Circuits : Combinational & Sequential, Boolean Logic, Truth Tables, Logic Families, Logic Gates, SoP and PoS form, K-Map Minimization of SoPs, Multiplexers Decoders Encoders Sequential Design Elements SR Latch, D Latch, D Flip Flop Registers, Counters, Shift Registers Design Examples Synchronous Sequential Circuits, Canonical Model of a State Machine, Types of State Machines, State Diagram, State Table, State Assignment, Moore and Mealy Model

Introduction to computer organization
Architecture and function of general computer system, CISC Vs RISC, Data types, Integer Arithmetic - Multiplication, Division, Fixed and Floating Point representation and arithmetic, Control unit operation, Hardware implementation of CPU with Micro instruction, microprogramming, System buses, Multi-bus organization.

Control Unit
Hardwired Control Unit, Micro-programmed Control Unit: Control memory, Address Sequencing, conditional branching, mapping of instructions, subroutine, Design of Control Unit.

CPU Registers
Program Counter, Stack Pointer Register, Memory Address Register, Instruction Register, Memory Buffer Register, Flag registers, Temporary Registers.

Instructions
Operational Code, Operands, Zero, One, Two and Three Address Instruction, Instruction Types, Addressing modes, Data Transfer and Manipulation instructions, Program control instructions.

Memory organization
Primary memory: ROM, PROM, EPROM, EEPROM, Flash memory, RAM: SRAM, DRAM, Cache Memory: Mapping Functions, Replacement Algorithms, Interleavd Memory, Hit ratio and Miss penalty, Virtual memory, Secondary Storage: Magnetic Disks, Optical Disks, Magnetic Tape Systems.

Input – output Organization
Polling, Interrupts, subroutines, Memory mapped IO, IO mapped IO, Direct Memory Access and DMA controller, Interrupts and Interrupt Controllers, Bus Arbitration, Multilevel Bus Architecture, Interface circuits - Parallel and serial port and buses

16 and 32 Bit-microprocessors
80x86 Architecture, IA – 32 and IA – 64, Programming model, Concurrent operation of EU and BIU, Real mode addressing, Segmentation, Addressing modes of 80x86, Instruction set of 80x86, I/O addressing in 80x86

Different Architectures
Pipeline, VLIW, DSP, SoC, Multiprocessor, GPU.

Text/Reference Books

1. Digital Logic and Computer Design by M. Moris Mano, 4th Edition.
2. V. Carl, G. Zvonko and S. G. Zaky, **"**Computer organization**"**, McGraw Hill, 1978.
3. B. Brey and C. R. Sarma, **"**The Intel microprocessors**"**, Pearson Education, 2000.
4. J. L. Hennessy and D. A. Patterson, **"**Computer Architecture A Quantitative Approach**"**, Morgan Kauffman, 2011.
5. W. Stallings, **"**Computer organization**"**, PHI, 1987.
6. N. Mathivanan, **"**Microprocessors, PC Hardware and Interfacing**"**, Prentice Hall, .
7. Y. C. Lieu and G. A. Gibson, **"**Microcomputer Systems: The 8086/8088 Family**"**, Prentice Hall India, 1986.
8. J. Uffenbeck, **"**The 8086/8088 Design, Programming, Interfacing**"**, Prentice Hall, 1987.
9. B. Govindarajalu, **"**IBM PC and Clones**"**, Tata McGraw Hill, 1991.
10. P. Able, **"**8086 Assembly Language Programming**"**, Prentice Hall India.

Paper Code: CSA/ThG/102
Programming & Data Structure

Introduction to Programming

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples from algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code, Arithmetic expressions and precedence, Conditional Branching and Loops Writing and evaluation of conditionals and consequent branching Iteration and loops, Arrays: (1-D, 2-D), Character arrays and Strings; Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference; Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc.; Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list; File handling

Introduction to Data Structures

Basic Terminologies: Elementary Data Organizations, Abstract Data Types, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Searching

Linear Search and Binary Search Techniques, and their complexity analysis.

Linked Lists

Singly linked lists: Representation in memory, Algorithms of operations: Traversing, Searching, Insertion into, Deletion from linked list; Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Stacks and Queues

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis. Linked representation of Stack and queue

Trees

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Applications of Data Structures

Text/Reference Books

1. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
3. “How to Solve it by Computer”, 2nd Impression by R. G. Dromey, Pearson Education.

Paper Code: CSA/ThG/103
Discrete Mathematics

Introduction
Basic Proof Techniques, Pigeonhole Principle, Induction & Strong Induction

Sets, Functions, Relations
Sets, Operations on sets. Generalized operations on sets, Finite and infinite sets, Countable and uncountable sets, Cardinal numbers.
Functions: Property of functions. Images and inverse images of sets of functions.
Relation: Relations, Operations on relations Classification of relations, Equivalence relation, Class of abstraction and quotient set, The principle of abstraction, Constructions of sets with the use of equivalence relations.

Group, Ring, Field, Polynomials

Equivalence Relations and Modular Arithmetic

Propositional & Predicate & Calculus
Logical sentence, Chart of the propositional condition, Logical connectives, Tautologies, The rules of proof construction, Predicate calculus: Alphabet, terms, formulas, sentences, complexity of formulas, syntactic manipulation of formulas, subformulas Tautologies of the predicate calculus, Examples of applications of tautologies, Formal proofs: Inference rules, normal form theorems, consistent sets of formula, logical consequence, correctness of proofs, Completeness theorem, Applications and consequences of the completeness theorem.

Graph
Basic Terminologies of Graphs, isomorphism, subgraphs, matrix representations, degree, operations on graphs, Walks, trails, paths, connected graphs, distance, cut-vertices, cut-edges, blocks, weighted graphs, connectivity, Dijkstra's shortest path algorithm, Floyd-Warshall shortest path algorithm Characterizations, number of trees, minimum spanning trees, Chromatic number and cliques, greedy coloring algorithm, Applications & Use cases.

Counting
Permutation, Combinations, Recursion and Recurrence Relation, Generating Functions

Text/Reference Books

1. J.A.Bondy and U.S.R.Murty: Graph Theory and Applications (Freely downloadable from Bondy's website; Google-Bondy)
2. D.B.West: Introduction to Graph Theory,Prentice-Hall of India/Pearson, 2009 (latest impression)
3. Enderton, Herbert B; A mathematical introduction to logic. Second edition.
Harcourt /Academic Press, Burlington, MA, 2001. xii+317 pp. ISBN: 0-12-238452-0
4. Goldrei, Derek; Propositional and Predicate Calculus: A Model of Argument.
Springer 2005, VIII, 315 p., ISBN: 978-1-85233-921-0

Paper Code: CSA/ThG/104
Probability and Statistics

Basic Probability
Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.

Continuous Probability Distributions
Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.

Bivariate Distributions
Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.

Basic Statistics:
Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Applied Statistics:
Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Small samples:
Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Text/Reference Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill.