

SYLLABUS COMPUTER SCIENCE

FOR

**4 YEARS U.G (HONOURS) PROGRAMME
4 YEARS U.G (HONOURS WITH RESEARCH)
PROGRAMME
AND
P.G. PROGRAMME**

EFFECTIVE FROM SESSION 2024-25 ONWARDS



**MAHARAJA SUHEL DEV UNIVERSITY
AZAMGARH (U. P.)-276128, INDIA**

**PREPARED BY
PROF. MOHD. SADIQ KHAN
PROFESSOR
DEPARTMENT OF COMPUTER SCIENCE
SHIBLI NATIONAL COLLEGE, AZAMGARH. (U.P.)**

**CONVENER OF COMPUTER SCIENCE
MAHARAJA SUHEL DEV UNIVERSITY
AZAMGARH (U. P.)-276128, INDIA**

M. Khan *+ Ad. S. Khan.*

H. Khan

Resolution

The meeting of Board of Studies (BOS) of COMPUTER SCIENCE was held on 14.10.2024 to consider and approve the NEP-2020 Framework & choice based credit systems Syllabus developed in accordance with G.O. शासनसं. संख्या-2090 / सार-3-2024-0901 / 2024 सं. दिनांक-02.09.2024

The following were present in the above said meeting:

S. No.	Name	Designation	Capacity
1	PROF. MANOJ KUMAR SINGH PROFESSOR, DEPT. OF COMPUTERSCIENCE, KASHI HINDU UNIVERSITY, VANARASI	PROFESSOR	EXTERNAL EXPERT
2	PROF. SURJEER KUMAR DEPT. OF COMPUTER APPLICATION, V.B.S.P.U., JAUNPUR.	PROFESSOR	EXTERNAL EXPERT
3	PROF. MOHD. SADIQ KHAN DEPT. OF MATHEMATICS SHIBLI NATIONAL COLLEGE, AZAMGARH.	PROFESSOR	CONVENOR
4	DR.NAFIS AHMAD DEPT. OF MATHEMATICS SHIBLI NATIONAL COLLEGE, AZAMGARH.	ASSOCIATE PROFESSOR	MEMBER
5	DR.SERAJ AHMAD KHAN DEPT. OF MATHEMATICS SHIBLI NATIONAL COLLEGE, AZAMGARH	ASSISTANT PROFESSOR	MEMBER

After detailed discussion, the BOARD OF STUDIES of Dt.14.10.2024 have unanimously approved the proposed Framework & Syllabus Computer Science and recommended that it may be implemented in accordance with above said G. O. under National Education Policy 2020.


(CONVENOR)

(EXTERNAL EXPERT)

(EXTERNAL EXPERT)


(MEMBER)


(MEMBER)

4th YEAR UG (HONS.) / 4th YEAR UG (HONS. WITH RESEARCH) ** /M.Sc. (Computer Science)

YEAR	SEM.	CATEGORY/TYP E OF THE COURSE	COURSE CODE	PAPER TITLE	THEORY /PRACTICAL	CREDIT
4 th YEAR UG (HONS.) / 4 th YEAR UG (HONS. WITH RESEARCH) / M.Sc. (1 st YEAR) /P.G. DIPLOMA	VII	MAJOR (COMPULSORY)	B070701T	Programming in C++	THEORY	4
			B070702T	Advanced DBMS	THEORY	4
			B070703T	Information Systems & Software Engineering	THEORY	4
		MAJOR (OPTIONAL)	OPTIONAL PAPERS	CHOOSE ANY ONE OF THE FOLLOWING		
			B070704T	(A) Discrete Mathematics & Numerical Methods OR	THEORY	4
			B070705T	(B) Advanced Computer Architecture		
	VIII	PRACTICAL (COMPULSORY)	B070706P	Programming Lab(C++) Lab	PRACTICAL	4
		MAJOR (COMPULSORY)	B070801T	Object Oriented Analysis & Java Programming	THEORY	4
			B070802T	Data Structure	THEORY	4
			B070803T	Design and Analysis of Algorithms	THEORY	4
		MAJOR (OPTIONAL)	OPTIONAL PAPERS	CHOOSE ANY ONE OF THE FOLLOWING		
			B070804T	(A) Data Communication & Networking OR	THEORY	4
			B070805T	(B) Compiler Design		
		PRACTICAL (COMPULSORY)	B070806P	Object Oriented Programming Java Lab	PRACTICAL	4

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M.Sc. (COMPUTER SCIENCE) SECOND YEAR

YEAR	SEM.	CATEGORY/TYP E OF THE COURSE	COURSE CODE	PAPER TITLE	THEORY/ PRACTICAL	CRED IT
M.Sc. SECOND YEAR	IX	MAJOR (COMPULSORY)	B070901T	Operations Research	THEORY	4
			B070902T	Software Engineering	THEORY	4
		MAJOR (OPTIONAL)	OPTIONAL	CHOOSE ANY ONE OF THE FOLLOWING		
			B070903T	(A) Soft Computing (artificial intelligence is covered in here)	THEORY	4
			B070904T	OR (B) Data Mining and Warehousing		
		PRACTICAL (COMPULSORY)	B070905P	OR Lab	PRACTICAL	4
	X	RESEARCH PROJECT	B070906R	RESEARCH PROJECT	PROJECT/ Dissertation	4
		MAJOR (COMPULSORY)	B0701001T	1. Artificial and deep Neural network	THEORY	4
		OPTIONAL GROUPS	OPTIONAL PAPERS	CHOOSE ANY ONE OF THE FOLLOWING GROUP		
		GROUP - A	B0701002T	2. Cloud Computing	THEORY	4
			B0701003T	3. Mobile Computing	THEORY	4
		GROUP - B	B0701004T	2. Basic Graph Theory	THEORY	4
			B0601005T	3. Quantum Computer Science	THEORY	4
		GROUP - C	B0701006T	2. Network Security	THEORY	4
			B0701007T	3. Bioinformatics	THEORY	4
		RESEARCH PROJECT	B0701008R	RESEARCH PROJECT	PROJECT/ Dissertation	4






Seventh Semester

COURSECODE- B070701T

CREDITS: 4

Programming in C++

Introduction: How C++ differs from C, Variables Declaration, Function overloading, Optional Parameters, Reference Variables, Operator over loading, Basics of Console Input and Output Constant Pointers. Dynamic Memory Allocation

Concepts: Overview of OOPs Principles, Introduction to classes & objects Creation & destruction of objects Data Members, Member Functions, this Pointer, Constructor & Destructor, Static class member, Friend class and functions, Namespace.

Inheritance and Polymorphism: Introduction and benefits, Access Specifier, Base and Derived class Constructors, Types of Inheritance, Down casting and up casting, Function over riding, Virtual functions, Destructor overriding, what is Polymorphism Pure virtual functions Virtual Base Class

I/O Streams and C++ Class Hierarchy File Stream, Text File Handling, Binary File Handling. Error handling during file operations, Overloading << and >> operators,

Exception Handling and Templates: Introduction to Exception, Benefits of Exception handling. Try and catch block, Throw statement, pre-defined exceptions in C++. Writing custom Exception class. Stack Unwinding. Function and class templates

Text & References:

1. C++ Primer 5th Edition, Stanley Lippman, 5th edition, Addison-Wesley
2. C++ Pocket Reference, 1st Edition, Kyle Loudon, O'Reilly
3. C++ in One Hour a Day, Sams Teach Yourself 8th Edition, Siddhartha Rao, 8th edition, Sams Publishing
4. C++ All-in-One For Dummies, 3rd Edition, Jeffrey M. Cogswell, For Dummies
5. C++: The Complete Reference, Herbert Schildt, 4th edition, McGraw Hill Education



Advanced DBMS

Overview of Database Management, Conceptual Database Design, Logical Database Design, Physical Database Design

Introduction to Relational Database : Relation, Optimization, The Catalog, Base Relvars and Views, Transactions, The Suppliers and Parts Database.

Relational Model Concepts, Relational Model, Constraining, Referential Integrity Constraints, Defining Referential Integrity Constraints, Update Operations on Relations, Structured Query Language (SQL), Data Definition Language Commands, Data Manipulation Language Commands, Transaction Control Commands, SQL Command Syntax and Usage, The Basic Query Block, Querying Data with Multiple Conditions, Basic Relational Algebra Operations, The Select Operation, Additional Relational Operations.

ER- and EER-to-Relational Mapping: ER- to Relational Mapping Algorithm, Summary of Mapping for Model Constructs and Constraints Mapping EER Model Concepts to Relations, Query, Processing and Optimization: Query Processing, Query Optimization, Database Tuning.

Object Oriented Database Systems: Characteristics of an Object-relation Database Management System (ORDBMS), Complex Objects, Inheritance, Function Overloading, Rules.

Distributed Database : Distributed Database System, Distributed Database Design, Data Fragmentation, Data Replication, Data Allocation, Query Processing in Distributed Databases.

Recovery: Transactions, Transaction Recovery, System Recovery, Media Recovery, Two-phase Commit.

Database Security: Security and Integrity Threats Intentional or Malicious Threats Defense Mechanisms, Security Policies, Authorization, Objects, View as objects, Granularity, Subject, Access Types.

Database Operating Systems: Features of a Database as Concurrency Control, A Concurrency Control Model Theory of Serializability Concurrency Control Algorithms, Concurrency Control Based on Timestamp Ordering Multiversion Concurrency Control Techniques, Optimistic Algorithm.

Multimedia Databases : Multimedia Data Formats, Continuous - Media Data, Similarity - Based Retrieval, Mobility and Personal Database, Database Technologies, Serving Database on the Web, Applying Databases to the Internet.

TextBooks:

1. Database System Concepts – 6th Edition by Silberschatz, Korth and Sudarshan
2. Fundamentals of Database Systems – 5th Edition by R.Elmasri, S. Navathe
3. Database Design and Relational Theory: Normal Forms and All That Jazz by C.J. Date



COURSECODE- B070703T

CREDITS: 4

Information Systems & Software Engineering

Introduction and I Sin Global Business Today. Global E-Business: How Business Use Information System, ITI infrastructure and Emerging Technologies, Foundations of Business Intelligence, Telecommunications, the internet, and wireless Technology, Securing Information Systems, Enterprise Applications, Knowledge Management, Enhancing Decision Making

Information gathering, requirement and feasibility analysis, data flow diagrams, process specifications, input/output design, process life cycle, software planning and managing the project (single & multi variable model), design, software modularity & metrics, coding, testing, implementation, maintenance, software quality and reliability

TextBooks:

1. Management Information Systems: Managing the Digital Firm-11th Edition by Kenneth C. Laudon Kenneth C. Laudon
2. Software Engineering: A Practitioner's Approach, 7/e by Roger S Pressman, R.S. Pressman & Associates, Inc.
3. An Integrated Approach to Software Engineering by P. Jalote, Springer

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+ Ed & Rev.

K. H. Khan

COURSE CODE- B070704T

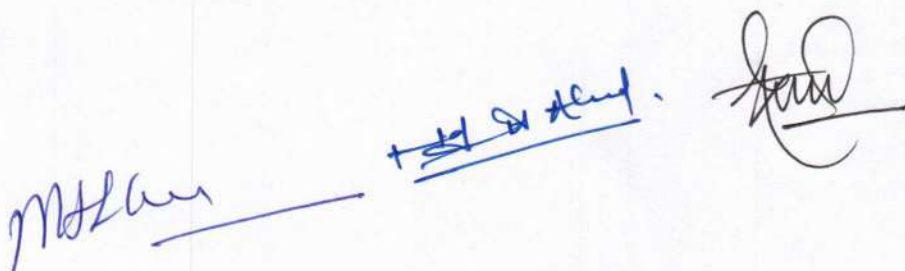
CREDITS: 4

Discrete Mathematics & Numerical Methods

Propositional logic, Logical equivalence, Permutation and combinations, Generating functions, Recurrence relations, Graph Theory Concepts Graphs, sub-graphs, cyclic graphs, Trees, spanning trees, binary trees, Algorithms- Kruskal's, Prim's, Dijkstra's, Floyd's, Warshall's, DFS, BFS, Isomorphism, homomorphism
Finite automata-
NFA, DFA, Conversion, Mealy M/C, Moore M/C, Introduction to Languages & Grammars and their relation with Automata.
Interpolation-
Newton's Forward, Backward, Sterling & Bessel's Interpolation formula, Lagrange's Interpolation
Integration- Trapezoidal, Simpson's 1/3rd, Weddle's Rule, Romberg Integration, Gauss-Legendre two & three point formula, Newton Cotes Formula.
Gram-Schmidt orthogonalisation, Tchebycheff polynomial
Solution of transcendental equations- Method of Iteration, Method of Bisection, Newton-Raphson Method, Regula-Falsi method, Secant Method.
Solution of system of linear equations- Gauss Elimination Method, Gauss-Jacobi, Gauss-Seidel, LU factorisation, Tri-diagonalisation. Inverse Interpolation. Least Square Curve fitting-linear & non-linear
Solution of Differential Equations- Picard's method, Euler-modified method, Taylor's Series method, Runge-Kutta method, Milne's Predictor-Corrector method

Text Books:

1. Theory of Computer Science, Mishra & Chandrasekharan, PHI
2. Discrete Mathematics for Comp. Scientists & Mathematicians, Mott, Kandel & Baker, PHI
3. Discrete Mathematical Structure, C.L. Liu, TMH
4. Discrete Mathematical Structure, G.S. RAO
5. Numerical Analysis, Shastri, PHI
6. Numerical Methods for Mathematics, Science & Engg., Mathews, PHI
7. Numerical Analysis & Algorithms, Pradeep Niyogi, TMH

The block contains three handwritten signatures in blue ink. The first signature on the left is 'Mishra'. The middle signature is 'Pradeep Niyogi' with a horizontal line through it, indicating it is crossed out. The third signature on the right is 'Mathews'.

Advanced Computer Architecture

Basic structure of Computer, Overview of von Neumann architecture, Number systems, Boolean postulates and laws, De-Morgan's Theorem, Boolean function, Minimization of Boolean expressions, SOP, POS, Karnaugh map, Logic Gates, Combinational and Sequential circuits. Overview of Arithmetic Unit, Processing Unit.

Memory Devices—RAM, ROM, Cache memory, Virtual memory, Secondary Storage
IO Organization—

Accessing I/O devices, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces—PCI, SCSI, USB

Basic Parallel Processing Architecture, Taxonomy—SISD, MISD, SIMD, MIMD structures, Serial, Parallel & Concurrent Computation, CISC vs RISC

Concepts of pipelining, Hierarchical Memory Technology: Inclusion, Coherence and locality properties

Concepts of instruction-level parallelism (ILP), Superscalar, superpipelined and VLIW processor architectures; Vector and symbolic processors

Multiprocessor Architecture, Taxonomy of parallel architectures; Centralized shared-memory architecture, synchronization, memory consistency, interconnection networks, Distributed shared-memory architecture, Cluster computers.

Non-von Neumann Architectures, Dataflow Computers, Reduction computer architectures, Systolic Architectures.

Text Books:

1. Digital Design, 3rd edition by M. Morris Mano, PHI publication
2. Computer Organization and Architecture—
Designing for Performance, 6th Edition by William Stallings
3. Advanced Computer Architecture: Parallelism, Scalability and Programmability by Kai Hwang

M. Shree

Prof. Dr. K. H. Hwang

Kai Hwang

COURSECODE- B070701T

CREDITS: 4

(Practical Lab-1)

Programming Lab (C++) Lab

Variables / types of variables, Input / output streams and validation of data, Operators - arithmetic, assignment, logical, bitwise , Conditions like if / else / switch, Arrays / , multidimensional arrays, Loops - for / while / do-while, Functions, overloading functions, passing variables to functions etc. Structures, References, Pointers, Dynamic Allocation Memory, Creating project in IDE, Classes Object Oriented Programming, Class And Function Templates, Namespaces, Exceptions

TextBooks:

1. C++ Primer 5th Edition, Stanley Lippman, 5th edition, Addison-Wesley
2. C++ Pocket Reference, 1st Edition, Kyle Loudon, O'Reilly
3. C++ in One Hour a Day, Sams Teach Yourself 8th Edition, Siddhartha Rao, 8th edition, Sams Publishing
4. C++ All-in-One For Dummies, 3rd Edition, Jeffrey M. Cogswell, For Dummies
5. C++: The Complete Reference, Herbert Schildt, 4th edition, McGraw Hill Education

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COURSE CODE- B070801T

CREDITS: 4

Object Oriented Analysis & Design (MCS201)

An Overview of Object Oriented Systems Development, Object Oriented Systems Development Life Cycle, Object Oriented methodologies, Rumbaugh Methodology, Jacobson Methodology, UML, Object Oriented Analysis & Design, software Quality and Usability, Case Studies

Introduction: Origin of JAVA, features of JAVA, JAVA Environment, Hardware and Software Requirements, Byte Code, Installing JDK, Difference between C++ and JAVA, Environment Variables, System Utilities, Command-Line I/O Objects, PATH and CLASSPATH, JAVA program structure, Variables, Primitive Data Types, Identifiers, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive type Conversion and Casting, Flow of Control (Conditional Statements, Loops, Branching Mechanism) Command Line Arguments.

Classes and Objects: Defining a class, creating objects, methods (declaration, invocation, overloading), constructors, garbage collection, static keyword, this keyword, arrays, inheritance and its types, method overriding, super keyword, final keyword, abstract class.

Interfaces and Packages: Defining Interface, Extending and implementing interface, interface vs. abstract classes. JAVA API packages, using system packages, naming conventions, creating packages, accessing a package, using package, adding class to a package.

Exceptions, Multithreading & I/O: Types of errors, exception handling techniques, user defined exceptions, multiple catch statements, finally statements. Multithreading, life cycle of a thread, creating new threads in 2 ways, thread priority. Streams and File I/O.

GUI and Advance Java: Applets, AWT, Client-Server architecture for web-based applications, Web Container, Servlets, JSPs

Text Books:

1. Object-Oriented Analysis and Design by Sarnath Ramnath, Brahma Dathan, Springer
2. Object-Oriented Analysis and Design With Applications, 3/E by Booch
3. Java: The Complete Reference 7/E by Herbert Schildt, TMH
4. Sachin Malhotra and Saurabh Chaudhary, "Programming in JAVA", Oxford University Press, ISBN : 0-19-806358
5. E-Balagurusamy, "Programming with JAVA- A Primer" Tata McGraw-Hill Publishers, ISBN 0-07-463542-5
6. Dietel and Dietel "CORE JAVA"
7. Herbert Shield "The complete reference-JAVA2", TMH



Data Structure

Data structures and Algorithms: an overview: concept of data structure, choice of right data structures, types of data structures, basic terminology Algorithms, how to design and develop an algorithm: stepwise refinement, use of accumulators and counters; algorithm analysis, complexity of algorithms Big-oh notation. Arrays, Stack, Queue, Pointers, and Linked Lists, Arrays: Searching Sorting: Introduction, One Dimensional Arrays, Operations Defined: traversal, selection, searching, insertion, deletion, and sorting. Multidimensional arrays, address calculation of a location in arrays, sparse matrix, sparse matrix representation. Pointers: Pointer variables, Pointer and arrays, array of pointers, pointers and structures, Dynamic allocation. Linked Lists: Concept of a linked list. Circular linked list, doubly linked list, operations on linked lists. Concepts of header linked lists. Applications of linked lists, linked stacks, linked Queues.

Searching and Sorting Searching: Linear search, Recursive and Non recursive binary Search., Sorting: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Shell sort, Heap sort Stacks and queues: Stacks, array representation of stack, Applications of stacks. Queues, Circular queues, array representation of Queues, Deque, priority queues, Applications of Queues.

Trees and Graphs: Introduction to trees, binary trees, representation and traversal of trees, operations on binary trees, types of binary trees, threaded binary trees, B Trees, Application of trees. Introduction to graphs, terminology, 'set, linked and matrix' representation, Graph traversal techniques: BFS, DFS, operations on graphs, Minimum spanning trees, Applications of graphs.

File Handling and advanced data Structure:

Introduction to file handling, Data and Information, File concepts, File organization, files and streams, working with files. AVL trees, Sets, list representation of sets, applications of sets, skip lists

TextBooks:

1. DataStructureusingCandC++-2ndeditionbyTanenbaum
2. FundamentalsOfDataStructuresInC++byEllisHorowitz,Sahni,DineshMehta
3. IntroductiontoAlgorithmbyThomasH.Cormen,CharlesE.LeisersonandRonald.L.Riveit,
4. TheDesignandAnalysisofComputerAlgorithmsbyAlfredV.Aho,JohnE.HopcroftandJeffreyD.Ullman.
5. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.
6. Data Structures using C by A. K. Sharma, Pearson
7. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
8. Fundamentals of Data structures by Ellis Horowitz & Sartaj Sahni, Pub, 1983, AW
9. Fundamentals of computer algorithms by Horowitz Sahni and Rajasekaran.
10. Data Structures and Program Design in C By Robert Kruse, PHI,
11. Theory & Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline by TMH
12. Introduction to Computers Science -An algorithms approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
13. Data Structure and the Standard Template library – Willam J. Collins, 20

COURSECODE- B070803T

CREDITS: 4

Design and Analysis of Algorithms (MCS203)

Introduction Brief Review of stacks, queues, graphs, binary search tree, set and disjoint set union, general sorting algorithms, Analysis of algorithms in terms of space and time complexity.

Divide and Conquer: General method, binary search, ternary search algorithm, merge sort, quick sort, selection, strassen's matrix multiplication, analysis of algorithms for these problems.

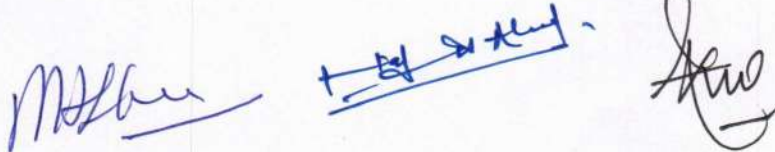
Greedy Method: General method, knapsack problem, job sequencing with deadlines, minimum spanning trees, single source paths, optimal storage on tapes, optimal merge patterns and analysis of these problems. Dynamic Programming: General method, single source shortest path, all pair shortest path, optimal binary search trees, 0/1 knapsack, the traveling salesman problem.

Back Tracking: General method, 8 queen's problem, graph coloring, sum of subsets, Hamiltonian cycles, analysis of these problems. Branch and Bound: General Method, 0/1 knapsack and traveling salesman problem.

NP-Hard and NP-Completeness: P, NP, NP-Hard, NP-Complete, Cook's Theorem and Problem Solving.

Text Books:

- Fundamental of Computer algorithms, Ellis Horowitz and Sartaj Sahni, 1978, Galgotia Publ.,
- Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald L Rivest: 1990, TMH.
- The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
- Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986.
- Johan Wiley & Sons,
- Writing Efficient Programs, Bentley, J.L., PHI
- Introduction to Design and Analysis of Algorithm, Goodman, S.E. & Hedetniemi, 1997, MGH



Data Communication & Networking

Fundamentals of data transmission, wired and wireless media, digital and analog transmission, data coding techniques, multiplexing, overview on OSI layers and TCP/IP model
Local Area Networks and data link protocols, point-to-point links and sliding window flow control, CSMA/CD, Ethernet, wireless LAN, cellular networks, and advanced multi-user communication (CDMA, SDMA/MIMO), mobility
Internetworking using TCP/IP: network programming using socket API, network client/server design
Packet/circuit switching and wide-area networks: store-and-forward networks, source routing, virtual/permanent, circuits and call set-up, LAN/WAN addressing, hop-by-hop vs. end-to-end control
Routing techniques - intra-domain routing (OSPF, RIP), inter-domain policy routing (BGP) and network connectivity
Transport protocols - TCP and UDP, Congestion control, TCP window control, multimedia streaming
High-level network services - DNS, HTTP, SMTP, network management (SNMP), network security, Security Requirement and attacks, Cryptography: Symmetric Key (DES, AES), Public Key Cryptography (RSA), Firewall.

Text Books:

1. Computer Networks by A.S. Tanenbaum, Fourth Edition, 2002, Pearson Education
2. Data Communication and Networking by B. Forouzan
3. Data and Communication by W. Stallings,
4. A.S. Tanenbaum : Computer Networks (4th ed.), Prentice-Hall of India.
5. W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.
6. P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.
7. Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGraw Hill.
8. L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, Morgan Kaufmann.
9. William Stallings : Data and Computer Communications, Pearson Education.



Compiler Design

Assembly language fundamentals, Assemblers- One pass and Two pass. Macro, Macro Processors- Macro definition and expansion. Macro processor algorithm, Macro processor Design options. Loading, Linking, Relocation, Program relocatability, Linkage editors, Bootstrap compilers.

Compilers- Compiler structure, compiler construction tools, Phases of compiler, Finite Automata, Push Down Automata (PDA), Non-determinism and NFA, DPDA and PDAs and languages accepted by these structures. Grammars, Languages-Types of grammars. The relationship between types of grammars, and finite machines. Push Down Automata (PDA) and Context free grammars (CFG). Lexical analysis: Specification and recognition of tokens, regular expressions and regular languages. LEX package on Unix. Conversion of NFA to DFA. Minimizing the number of states to DFA.

Context free grammars (CFG): Parsing and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Top-down parsers-left recursion and its removal, Recursive descent parser and predictive parser. Bottom up parsers-shift reduce, operator precedence parsing, LR parsers. YACC package on Unix system. Intermediate Codes-Quadruples, triples. Intermediate code generation, Code generation, Code Optimization-optimization.

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1.2.3.4.5.6.7.8.9.10.11.12.13.14.15.16.17.18.19.20.21.22.23.24.25.26.27.28.29.30.31.32.33.34.35.36.37.38.39.40.41.42.43.44.45.46.47.48.49.50.51.52.53.54.55.56.57.58.59.60.61.62.63.64.65.66.67.68.69.70.71.72.73.74.75.76.77.78.79.80.81.82.83.84.85.86.87.88.89.90.91.92.93.94.95.96.97.98.99.100.

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(Practical Lab-2)**Object Oriented Programming Java Lab**

Java Classes, Installation, Data types, variable, arrays, expressions, operators, and control structures, Objects and classes, Abstract classes, Static classes, Inner classes, Packages, Wrapper classes, Interfaces, Access control
Exception handling and IO package, Exception as objects, Exception hierarchy, Try catch, finally Throw, throws, Input streams, Output streams, Object serialization, Deserialization, Sample programs on IO files, Filter and pipe streams

Multi-threading and GUI, Thread Life cycle, Multithreading advantages and issues, Simple thread program, Thread synchronisation, Introduction to AWT programming Layout and component managers
Event handling, Applet class, Applet life cycle, Passing parameters embedding in HTML, Swing components – JApplet, JButton, JFrame, etc. Sample swing programs

Database Connectivity, JDBC architecture, establishing connectivity and working with connection interface
Working with statements, Creating, and executing SQL statements, J2EEoverview,Servlet &JSP.



COURSECODE- B070901T

CREDITS: 4

Operations Research

Introduction to OR, Quantitative approach to management decision making, Analyzing and defining the problem, Developing a model, Selecting the inputs and putting the model to work, Typical applications of OR.

Linear Programming, Formulating maximization/minimization problems, Graphical solution, simplex methods, Special cases of LP, Duality of LP and its interpretation, Dual simplex methods, Post Optimality/sensitivity analysis, Applications of LP. Transportation and Assignment problems, VAM method, checking for optimality using MODI method, Unbalanced problem and degeneracy, Hungarian method for assignment problem, traveling salesman problem.

Game theory-2 Person zero sum games, Saddle point, Mixed strategies use of dominance rules, Solution by graphical methods.

Simulation Modeling - Monte Carlo simulation, Using random numbers, Applications in inventory analysis.

Replacement models - Types of replacement problems, Replacement of assets that deteriorate with time, Markov Analysis: Brand switching analysis, Prediction of market shares for future periods, Equilibrium conditions, Uses of Markov analysis.

PERT, CPM, Network Analysis, Critical Path, Determination of Float

Text Books:

1. Operations Research by A Ravindran, Don T Philips and James J Solberg.
2. Operations Research by Hamdy A Taha

M. K. S.

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Software Engineering

Introduction to Software Engineering:

What is software engineering? Software engineering costs, what are the key challenges facing software engineering? Systems engineering & software Engineering, the evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Requirements, Analysis, and specification

Software Requirements engineering, Requirement engineering process, Requirement Engineering Tasks, Types of requirements, SRS.

System modelling

Data Modeling, Functional modelling and information flow: Data flow diagrams, Behavioural Modeling, The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the data dictionary. Process modeling with physical and logical DFDs

System Design

Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling; Design Heuristics for effective modularity, Data Design, Architecture Design, Interface Design

Software Testing and maintenance

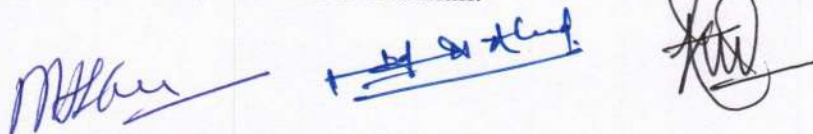
Testing terminology—error, bug/defect/fault, failure, Verification and validation, Test case design, Static testing, Dynamic testing--- Black box testing—Boundary value analysis, White box testing-- basis path testing, Unit testing, Integration testing, Acceptance Testing, debugging, debugging process debugging approaches. Software maintenance categories, Models

Software Quality Models and Standards

Quality concepts, Software quality assurance, SQA activities, Formal approaches to SQA; Statistical software quality assurance; CMM, The ISO 9126 Standard

Text & References:

1. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering, Rajib Mall, PHI
3. Software Engineering by Ian Sommerville, Pearson Edu, 5th edition, 1999, AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995
6. JW&S,
7. An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa
8. Software Testing: Principles and Practices, Dr. Naresh Chauhan.



Soft Computing**Module 1: Introduction to Soft Computing**

Concept of computing systems., soft vs hard computing hard computing, Characteristics of Soft computing, Applications of Soft computing techniques

Module 2: Fuzzy logic

Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minimax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

Module 3: Genetic Algorithm:

History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

Module 4: Neural Networks:

What is Neural Network, Learning rules and various activation functions, Single layer Perceptron, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications?

Module 5: Backpropagation Networks

GA based Backpropagation Networks (GA based Weight Determination, K - factor determination in Columns), Fuzzy Backpropagation Networks (LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks)

TextBooks:

1. Introduction to Artificial Intelligence and Expert Systems by D.W. Patterson
2. Artificial Intelligence: A Modern Approach-3rd edition by Stuart Russell & Peter Norvig
3. Artificial Intelligence by Elaine Rich & Kevin Knight
4. Principles of Artificial Intelligence by J. Nilsson, Narosa Publishing House
5. S. Rajasekaran and G. A. Vijayalakshmi Pai: Neural Network, Fuzzy Logic and Genetic
6. Algorithm (Synthesis and Applications) PHI
7. M. Mitchell: An Introduction to Genetic Algorithms, Prentice-Hall India.
8. J.S.R. Jang, C.T. Sun and E. Mizutani: Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.
9. M. Ganesh: introduction to Fuzzy Sets and Fuzzy Logic, PHI.
10. Timothy J. Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.
11. D.E. Goldberg : Genetic Algorithms in Search, Optimization, and Machine Learning,
12. Addison-Wesley.
13. Z. Michalewicz: Genetic Algorithms + Data Structures = Evolution Programs, Springer-Verlag.
14. N.K. Sinha & M.M. Gupta (Eds): Soft Computing & intelligent Systems: Theory & Applications, Academic Press.

Data Mining and warehousing

Introduction to Data Mining. Different kinds of data and patterns that are mined. Technologies used. Applications, Major Issues. Data Objects and Attribute Types, Basic tatistical Description of Data, Data visualization, Measuring Data Similarity and dissimilarity. Data Pre-processing, Data cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data mining algorithms: Association Rule Mining, Classification and Prediction: -Issues Regarding Classification and Prediction, Classification by Decision Tree. Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machine , Associative Classification , Lazy Learners , Other Classification Methods

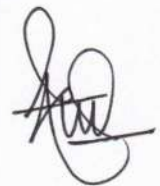
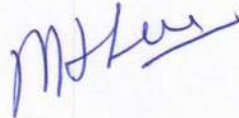
Basic concepts of Data Warehousing. Data warehousing modelling: Data cube and OLAP –Data warehouse design and usage. Data Warehouse Design and usage. Data warehouse Implementation. Data cube Technology. Classification, Decision Tree Induction, Bayes classification, Rule based classification, classification by back propagation.

Types of Data in Cluster Analysis, Model-Based Clustering Methods, Hierarchical and Partitioning methods. Outlier–Outlier detection techniques. Data mining Applications, Data mining and society. Data mining Trends, Data mining software.

Advanced Techniques, Web Mining, Text mining, Spatial and Temporal Mining. Sequential Pattern Mining Mining Spatiotemporal and Trajectory Patterns, Multivariate Time Series (MVTs) Mining

Text & References:

- J Han, M Kember, J Pei, Morgan Kaufman, "Data Mining : Concepts and Techniques" , 3rd ed.,
- Alex Berson, Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata McgrawHill, 2004.
- Berry Micheal and Gordon Linoff, Mastering Data Mining. John Wiley & Sons Inc.
- Witten, E. Frank, M. Hall. "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann Publishers, 2011.



Tenth Semester

COURSECODE- B0701001T

CREDITS: 4

Artificial and deep Neural network

Neural Networks Overview, Neural Network Representation, Computing a Neural Network's Output, Vectorizing across multiple examples, Explanation for Vectorized Implementation, Activation functions, Why do you need non-linear activation functions?, Derivatives of activation functions, Gradient descent for Neural Networks, Backpropagation intuition, Random Initialization.

Binary Classification, Logistic Regression Cost Function, Gradient Descent, Derivatives, More Derivative Examples, Computation graph, Derivatives with a Computation Graph, Logistic Regression Gradient Descent, Gradient Descent on m Examples, Vectorization, More Vectorization Examples, Vectorizing Logistic Regression, Vectorizing Logistic Regression's Gradient Output, Explanation of logistic regression cost function

Deep L-layer neural network, Forward Propagation in a Deep Network, Building blocks of deep neural networks, Forward and Backward Propagation, Parameters vs Hyperparameters, What does this have to do with the brain?

Text & References:

- • Deep learning: adaptive computation and machine learning, Bengio, Yoshua, Courville, Aaron, Goodfellow, Ian J
- • Deep Learning: A Practitioner's Approach, J. Patterson, A. Gibson
- • Neural Networks and Deep Learning: A Textbook, Charu C. Aggarwal
- • Neural Networks and Deep Learning, Michael Nielsen.



Cloud Computing

Introduction: Cloud computing definition, reference model, Characteristics, Benefits, Challenges, Distributed Systems, Virtualization, Service-oriented computing, Utility-oriented computing, Overview on computing platforms & technologies – AWS, Google App Engine, MS Azure, Hadoop, Salesforce.com, Manjrasoft Aneka

Parallel & Distributed Computing: Parallel vs. Distributed computing, Elements of parallel computing, Parallel processing-hardware architecture & approaches, Concept & Component of Distributed Computing, RPC, Service-oriented computing

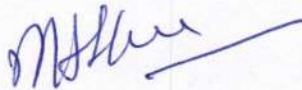
Virtualization: Cloud reference model – IaaS, PaaS, SaaS, Types of clouds – Public, Private, Hybrid, Community, Cloud interoperability & standards, scalability & fault tolerance, Security, trust & privacy

Concurrent Computing, High-throughput Computing and Data-Intensive Computing: Programming applications with Threads, Thread API, Parallel computation with Threads, Task computing, Frameworks for Task computing, Task-based application model, Data-intensive computing, characteristics, technology

Cloud Platforms and Applications: Overview on Amazon Web Services, Google App Engine and Microsoft Azure, Cloud applications in scientific, business and consumer domain

Text Books:

1. Buyya, Vecciola and Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Tata McGraw Hill
2. Rittinghouse and Ransome, Cloud Computing: Implementation, Management, and Security, CRC Press
3. Aravind Doss, Cloud Computing, Tata McGraw Hill
4. Krislamsa, Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More, Jones & Bartlett Learning



Mobile Computing

Introduction and Application of Mobile Computing, Wireless
 Transmission: Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, Modulation, Spread spectrum, Cellular systems
 Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; SOMA, FOMA
 TOMA: Fixed TOM, Classical Aloha, Slotted Aloha, Carrier sense multiple access, Demand assigned multiple access, PRMA packet reservation multiple access, PRMA packet reservation multiple access, reservation TOMA, Multiple access with collision avoidance, Polling, Inhibit sense multiple access
 CDMA: Spread Aloha multiple access
 Telecommunication Systems: GSM: Mobile Services, System Architecture, radio interface, Protocols, Localization and Calling, Handover, Security, New Data Services, DECT, Systems Architecture
 Protocol Architecture: TETRA, UMTS and IMT-2000, UMTS Basic Architecture, UTRA FDD mode, UTRA TDD mode
 Satellite Systems: History, Applications, Basics: GEO, LEO, MEO, Routing, Localization, Handover
 Examples Broadcast Systems: Overview, Cyclic Repetition, Digital Audio; broadcasting: Multimedia object transfer protocol; Digital Video broadcasting
 Wireless LAN: Infrared vs. Radio Transmission, Infrastructure and Ad Hoc networks, IEEE 802.11: System Architecture, Protocol Architecture, Physical Layer, Medium Access Control Layer, MAC management, Future development; HIPERLAN: Protocol architecture, Physical Layer Channel access control. Sublayer, Medium Access control sublayer, Information bases and networking;
 Bluetooth: User Scenarios, Physical Layer, MAC layer, Networking, Security, Link management.
 Wireless ATM: Motivation for WATM, Wireless ATM working group, WATM services, Reference model: Example configurations, Generic reference model;
 Handover: Handover reference model, Handover requirements, Types of handover, Handover scenarios, Backward handover, Forward handover; Location management: Requirements for location management, Procedures and Entities; Addressing, Mobile quality of service, Access point control protocol.
 Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunneling and Encapsulation, Optimizations, Reverse tunneling, IPv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics.
 Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fast retransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.
 Support for Mobility: File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol, Hypertext markup language, Some approaches that might help wireless access, System architectures;
 Wireless application protocol: Architecture, Wireless data grammar protocol, Wireless transport layer security, Wireless transaction protocol, Wireless session protocol, Wireless application environment, Wireless markup language; WML script, Wireless telephony application, Examples "Stacks with WAP, Mobile databases, Mobile agents, Security and privacy aspects of Mobile Computing.

Text Books:

1. Jochen Schiller, Mobile Communications, 2nd Edition, Pearson
2. William Stallings, Wireless Communications and Networks, PHI
3. Rappaport, Wireless Communications Principles and Practices, PHI
4. Yi Bing Un, Wireless and Mobile Network Architectures, John Wiley

Basic Graph Theory

Fundamental concepts of graphs Basic definitions of graphs and multi graphs; adjacency matrices, isomorphism, girth, decompositions, independent sets and cliques, graph complements, vertex coloring, chromatic number, important graph like cubes and the Petersen graph, Paths, cycles, and trails; Eulerian circuits. Vertex degrees and counting; large bipartite sub graphs, the handshake lemma, Havel-Hakimi Theorem. Directed graphs: weak connectivity, connectivity, strong, components, Induction and other fundamental proof techniques

Trees Basics: equivalent characterizations of trees, forests, Spanning trees and 2-switches, Distance and center, Optimization: Kruskal's Theorem and Dijkstra's Theorem

Matching and covering Bipartite matching, vertex cover, edge cover, independent set, M-alternating path, Hall's Theorem, König-Egeváry Theorem, Gallai's Theorem

Connectivity and Network flow Vertex cuts, separating sets, bonds; vertex and edge connectivity, block-cutpoint tree, Menger's Theorem: undirected vertex and edge versions, Ford-Fulkerson Labeling algorithm, flow integrality, Max-flow/Min-cut Theorem, proof of Menger's Theorem

Coloring and Planarity Chromatic number: lower bounds from clique number and maximum independent set, upper bounds from greedy coloring (& Welsh-Powell), Szekeres-Wilf, and Brooks' Theorem. Also k-critical graphs, cartesian product of graphs, and interval graphs, k-Chromatic graphs: Mycielski's construction, Turán's Theorem, Edge coloring, line graphs, Vizing's Theorem Embeddings, dual graphs, Euler's formula Kuratowski's Theorem, Coloring, including the 5-color theorem

Text & References:

- A Walk Through Combinatorics, Miklos Bona
- Doug West, Introduction to Graph Theory
- Alan Tucker's Applied Combinatorics
- Pearls in Graph Theory: A Comprehensive Introduction by Nora Hartsfield
- *Introduction to Graph Theory* by Richard J. Trudeau
- Graph and Digraphs, by Chartrand, Lesniak, and Zhang
- Bollobás's Modern Graph Theory
- Introduction to Graph Theory by Wilson.
- Graph Theory: Modeling, Applications, and Algorithms by GeirAgnarsson



Quantum Computer Science

Introduction: Elementary quantum mechanics: linear algebra for quantum mechanics, Quantum states in Hilbert space, The Bloch sphere, Density operators, generalized measurements, no-cloning theorem.

Quantum gates and algorithms.

Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring, Simon's algorithm, Period Finding Shor's Algorithm QFT (Basics), The prime factorization algorithm, Grover's search algorithm

Quantum Computation and optimization

Implement quantum programs in NISQ model of computing, Current machines (5-50 qubit) What is NISQ Model?, NISQ Metrics, Qubit Mapping Problem Qubit Allocation Problem, Become familiar with Quantum Approximate Optimization Algorithm, Maxcut problem Overview of QAOA Optimizations for QAOA

Quantum error correcting codes

Types of error, s Device Level, Metrics System Level, Metrics Benchmarking, Analyze software-based techniques for reducing the error rate of NISQ, Variability-Aware Mapping Diversity-Aware Mapping Reducing Measurement Errors Reducing Idling Errors

Quantum cryptography

Quantum key distribution, Bell's theorem and EPR paradox

Text & References:

- Nielsen, Michael A., and Isaac L. Chuang. *Quantum Computation and Quantum Information*. Cambridge, UK: Cambridge University Press, September 2000. ISBN: 9780521635035.
- Preskill, J. Notes on Quantum Computation.
- Peres, Asher. *Quantum Theory: Concepts and Methods*. New York, NY: Springer, 1993. ISBN: 9780792325499.

Three handwritten signatures are present at the bottom of the page. The first signature on the left is 'M. Khan'. The middle signature is crossed out with a blue line and has the word 'cancel' written above it. The third signature on the right is a stylized signature.

Network Security

Concepts and Terminology: Threats, Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, Spoofing, Sniffing, Firewall.

Cryptography: Techniques, Mathematical foundation, StreamCiphers, Block Ciphers, Cryptanalysis, Hash Algorithms.

SecretKeyCryptography:Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Keyexpansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB,MultipleencryptionsDES.

HashFunctionsandMessageDigests:Lengthofhash,uses,algorithms(MD2,MD4,MD5,SHS)MD2:Algorith
hm(Padding,checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.)
SHS:Overview,padding,stages.

PublickeyCryptography:Algorithms,examples,Modulararithmetic(addition,multiplication,inverse,andex
ponentiation) RSA: generating keys, encryption and decryption. Other Algorithms:PKCS,Diffie-
Hellman,El-Gamalsignatures,DSS,Zero-knowledgesignatures.

Authentication:PasswordBased,AddressBased, Cryptographic Authentication. Passwords indistributed
systems, on-line vs offline guessing, storing. Cryptographic Authentication:passwordsaskeys,
protocols,KDC'sCertificationRevocation,Inter-domain,
groups,delegation.AuthenticationofPeople:Verificationtechniques,passwords,lengthofpasswords,passwo
rddistribution,smartcards,biometrics.

SecurityPoliciesandSecurityHandshakePitfalls:Whatis security policy,highandlowlevelpolicy,user
issues?Protocolproblems,assumptions,Sharedsecretprotocols,publickeyprotocols,mutualauthentication,r
eflectionattacks,useoftimestamps,nonce andsequencenumbers,sessionkeys,one-andtwo-
waypublickeybasedauthentication.

Network Security:Electronicmailsecurity,IPsecurity,Network managementsecurity.

-Securityforelectroniccommerce:E-
commercesecurityanalysis,protocol,SSL,SETSystemSecurity:IntrudersandViruses,Firewalls,IntrusionD
etection.

CaseStudies

Web threats, E-mail threats, Domain controller threats, Extranet and VPN
threats.AssignmentandProjectwork.

TextBooks:

1. AtulKahate,CryptographyandNetworkSecurity,McGrawHill
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security,
PrivateCommunicationinapublicworld,2nded.,PrenticeHallPTR.,2002
3. Stallings, W.,CryptographyandNetworkSecurity:PrinciplesandPractice,3rded.,PrenticeHallPTR.
,2003
4. Stallings, W.NetworksecurityEssentials:Applicationsandstandards,PrenticeHall,2000
5. CryptographyandNetworkSecurity;McGrawHill;BehrouzAForouzan
6. InformationSecurityIntelligenceCryptographicPrinciplesandApp.CalabreseThomson
7. D.P.Nagpal,InformationSecurity,S.ChandComplanyLimited
8. 7.SecuringAWirelessNetworkChrisHurleySPD.

M. Khan

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Bioinformatics**Bioinformatics and Biological Sequence Databases**

Overview of Bioinformatics, computational biology, History, Human Genome Project, Biological Sequence Databases (Primary, Secondary, composite), NCBI, PDB, bibliographic databases

Sequence Alignment

Sequence analysis of biological data, methods of alignment and methods for optimal alignments, dynamic programming, using gap penalties and scoring matrices, multiple sequence alignment tools for MSA (MUSCLE, T-coffee), Similarity Searching Tools: BLAST and FASTA,

Molecular Phylogeny

The concept of evolutionary tree terminology of phylogenetics, introduction to evolutionary models, Types of phylogenetic trees (rooted vs. unrooted trees). Phylogenetic analysis algorithms: UPGM, Fitch Morgalish, Neighbors-Relation, Neighbor-Joining, maximum Parsimony, maximum likelihood, Tree evaluation methods: Bootstrapping, Randomized and jack-knifing methods

Predictive Methods

Gene Identification methods, Protein structure prediction methods: Secondary and tertiary approaches

Molecular modelling & Drug designing

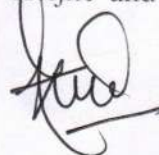
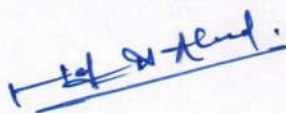
Molecular docking and virtual high-throughput screening,

Systems Biology

The process of system biology research, Interlinkage of Genomic, Transcriptomics, Proteomics, Lipidomic, Interactome and metabolomics

Text & References:

1. Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.
2. Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
3. Biocomputing hypertext coursebook at <http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/>
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxeavanis and B.F.F. Ouellette, Wiley-interscience.
5. Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
6. Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
7. Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N. Abelson, M.I. Simon, Academic press
8. Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
9. Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
10. Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
11. Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press



Research Project Guidelines for IX and X Semester

1. Objectives of the Project

- To facilitate the student to independently formulate and solve a social, philosophical, commercial, or technological problem and present the results in written and oral form.
- To render students to the real life problems.
- To provide opportunities to students to interact with people and present them confidently.

2. Types of Project

The students are expected to work on:

- (1) Application Oriented Project or
- (2) Research Oriented Project.

However, it is not mandatory for a student to work on a real-life project. The student can formulate a project problem with the help of his Guide and submit the project proposal of the same. **Approval of the project proposal is mandatory.** If approved, the student can commence working on it, and complete it. It is upon the student to carry the same project of V semester to VI semester OR choose a new project for VI semester. Use the latest versions of the software packages for the development of the project.

3. Software and Broad Ideas of Application

- **Languages** - C, C++, Java, VC++, C#, R, Python
- **Scripting Languages** - PHP, JSP, SHELL Scripts (Unix), Tcl/Tk
- **.NET Platform** - F#, C#. Net, Visual C#. Net, ASP.Net
- **Middle Ware(Component) Technologies** - COM/DCOM, Active-X, EJB
- **Front-End/GUI Tools** - .Net Technologies, Java
- **Back-End/DBMS** - Oracle, SQL Plus, MY SQL, SQL Server
- **UNIX Internals** - Device Drivers, RPC, Threads, Socket programming
- **Real time Operating Systems/Embedded Skills** - LINUX, Raspberry Pi, Arduino.
- **Application and Research Areas** - Financial / Insurance / Manufacturing / Multimedia / Computer Graphics / Instructional Design/ Database Management System/ Internet / Intranet / Computer Networking-Communication Software development/ E-Commerce/ ERP/ MRP/ TCP-IP programming / Routing protocols programming/ Socket programming

4. Eligibility of the Guide

Guide should be a regular teacher of the University/College/Higher Education Institute. Student can also do the project under the guidance of regular teacher of Institute of National Importance .

5. Introduction to the Project

The student should include the details in the project diary, in which they will record the progress of their project throughout the course. The project report should be documented with scientific approach to the solution of the problem that the students have sought to address. The project report should be prepared in order to solve the

problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. The project report should contain enough details to enable examiners to evaluate the work. The important points should be highlighted in the body of the report, with details often referred to appendices.

6. Structure and Format of the Project

Chapter 1 to 4 should be submitted in Semester V in spiral binding and these chapters have also to be included in Semester VI report if same project is carried from V to VI semester. If different projects are taken than complete project report is to be submitted in each semester. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the project in V and VI semester independently.

(i) Title Page:

Sample format of Title page is given below. Students should follow the given format.

(All the text should be in Times New Roman)

<TITLE OF THE PROJECT>
(NOT EXCEEDING 2 LINES, 24 BOLD, ALL CAPS)

A Project Report (12 Bold)

Submitted in partial fulfillment of the
Requirement of the award of the Degree of (Size- 12)

BACHELOR OF SCIENCE (14 BOLD, CAPS)

By (12 Bold)

Name of The Student (Size 15, title case)
Roll Number (Size- 15)

COLLEGE LOGO

DEPARTMENT NAME

FACULTY NAME (12 BOLD, CAPS)

UNIVERSITY/COLLEGE NAME (14 BOLD, CAPS)
Affiliated to University Name) (12, Title case, bold, talic)

CITY, PIN CODE(12 bold, CAPS)
UTTAR PRADESH (12 bold, CAPS)
YEAR (12 bold)



- (ii) **Original Copy of the Approval Proforma of the Project Proposal:**
Sample Proforma of Project Proposal is given below. Students should follow the given format.

PROFORMA FOR THE APPROVAL OF PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be rejected)

Roll no:.....

1. Name of the Student
.....

2. Title of the Project
.....

3. Name of the Guide
.....

4. Teaching experience of the Guide
.....

Signature of the Student
Date:.....

Signature of the Guide
Date:.....

Signature of the Project Coordinator
Date:.....

- (iii) **Certificate of Authenticated work:**
Sample format of Certificate of Authenticated work is given below. Students should follow the given format. Also, HEIs/Institutes/Colleges are required to give plagiarism report for the project work.

UNIVERSITY/COLLEGE NAME (14 BOLD, CAPS)
(Affiliated to University Name) (13, bold, italic)
CITY NAME-PINCODE (13 bold, CAPS)
DEPARTMENT NAME (14 BOLD, CAPS)
College Logo
CERTIFICATE (14 BOLD, CAPS, underlined, centered)

This is to certify that the project entitled, "**Title of The Project**", is bonafied work of **NAME OF THE STUDENT** bearing **Roll No.** submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in COMPUTER SCIENCE from **University Name**. (12, times new roman, justified)

Name of Internal Guide (12 bold) Name of Coordinator
(Don't write names of lecturers or HOD)

External Examiner

Date: College Seal

M. K. S.

24/05/2024

[Signature]

- (iv) **Certificate from other Institute of National Importance** (to be issued by the HEI and the photocopy of the certificate is to be attach)

(v) **Abstract**

This should be one/two short paragraphs (100-150 words total), summarizing the project work. It will not be a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to determine if the project is of interest to them and, it should present results of which they may wish to know more details.

(Project Abstract page format)

Abstract (20bold, caps, centered)

Content goes here (12, justified)

Note: Entire document should be with 1.5 line spacing and all paragraphs should start with 1 tab space.

(vi) **Acknowledgements**

This should express student's gratitude to those who have helped in the preparation of project.

ACKNOWLEDGEMENT (20, BOLD, ALL CAPS, CENTERED)

The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, Justified.

(vii) **Declaration**

(Declaration page format)

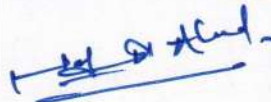
DECLARATION (20 bold, centered, allcaps)

Content (12, justified)

I here by declare that the project entitled, "**Title of the Project**" done at [**name of place where projects is done**] has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other universiny.

The project is done in partial fulfilment of the requirements for the award of degree of **BACHELOR OF SCIENCE** to be submitted as [**V OR VI**] semester project as part of our curriculum.

Name and Signature of the Student



(viii) **Table of Contents**

The table of contents gives the readers a view of the detailed structure of the report. The students would need to provide section and subsection headings with associated pages. The formatting details of these sections and subsections are given below.

TABLE OF CONTENTS (20 bold, caps, centered)

Should be generated automatically using word processing software.

	Chapter 1: Introduction	
	1.1 Background	01(no bold)
Objectives	02(no bold)	
Purpose and Scope	03	
Purpose		
Scope		
	Chapter 2: Survey of Technologies	
	2.1.....	
Problem Definition	Chapter 3: Requirements and Analysis	
Requirements Specification		
	Chapter 4: System Design	
Basic Modules		
Data Design	Chapter 5: Implementation and Testing	
		
	Chapter 6: Results and Discussion	
		
	Chapter 7: Conclusions	
		
	REFERENCES	
	GLOSSARY	
	APPENDICES	

(ix) **List of Tables**

List of all the tables in the project along with their page numbers.

List of Tables (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

M. Khan *1st 2nd 3rd* *Khan*

(x) **List of Figures**

List of all the figures, graphs, charts etc. in the project along with their page numbers.

List of Figures (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

Chapter 1: Introduction

The introduction has several parts as given below:

- Background: A brief detail of background and framework of project and its relation to work done in the area.
- Objectives: Point wise statement of the aims and objectives of the project
- Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:
 - Purpose: Describe the topic of the project on the basis of why this project is being done. How this project improve the existing system.
 - Scope: Describe methodology, assumptions and limitations.
 - Applicability: State the application of project.
- Achievements: Explain what kind of purpose is achieved after completion of project.
- Organization of Report: Summarize remaining chapters of the project report.

(Project Introduction page format)

Chapter 1

Introduction (20 Bold, centered)

Content or text (12, justified)

Note: Introduction has to cover brief description of the project with minimum 4 pages.

Chapter 2: Literature Review OR Survey of Technologies

In this chapter survey of technologies for application oriented project should demonstrate the student awareness and understanding of available technologies OR literature survey is required for research oriented project. The student should give the detail of all the related literature/technologies that are necessary to complete the project. The student should present a comparative study of all those technologies/literature.

Chapter 3: Requirements and Analysis (For Application Oriented) OR [Title of Research Working Chapter]



Chapter 4: System Design (For Application Oriented) OR [Chapter related to Research Work]

Chapter 5: Implementation and Testing

- **Implementation Approaches:** Define the plan of implementation, and the standards or standard data sets used in the implementation.
- **Coding Details and Code Efficiency:** Students not need include full source code, instead, include only the important codes (design of new data structure, algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way. The student can explain the function of the code with a shot of the output screen of that program code. The student should explain how the code is efficient and how the students have handled code optimization.
- **Testing Approach**
- **Modifications and Improvements**

Chapter 6: Results and Discussion

- **Test Reports:** Student should provide the test results and reports based on the test cases to show that it works fine in different conditions of input.
- **User Documentation:** In this section, working of the software should be explained; also explain its different functions with screen shots. The user document should be like a manual.

Chapter 7: Conclusions and Future Work

The conclusions shall be summarized with in 2 or 3 pages. This chapter mainly focuses on:

- Limitations of the Proposed System OR Research.
- Future Scope describes new areas of investigation and parts of the current work that was not completed due to time constraints and/or problems encountered.

(xi) References

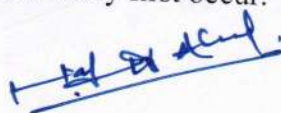
In this, students acknowledge the work of others that they have used or adapted in their own work. Student can follow the given standard for the references for books, journals, and online material. The citation is mandatory in both the reports.

Eg.

Lipson, Charles (2011). Cite right : A quick guide to citation styles; MLA, APA, Chicago, the sciences, professions, and more (2nd ed.). Chicago [u.a.]: University of Chicago Press. p. 187. ISBN 9780226484648.

(xii) Glossary

If any acronyms, abbreviations, symbols, or uncommon terms is used in the project report then their meaning should be explained where they first occur.



(xiii) **Appendices**

Appendix include some further details like results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

7. Evaluation

- During the project work, its progress will be monitored, on fortnightly/monthly basis, by the internal guide.
- 2 copies of Project Report to be submitted to department (1 copy to be retained by department, 1 copy for student)
- End Examination shall be based on Project Report, Presentation, Viva, and Demonstration of the software.
- Project carries 3 Credit Points.

Duration (for 1 group):

Evaluation in V and VI semester separately		
Type of evaluation	Total time	Max. Marks
Presentation	10 minutes	25
Viva	10 minutes	20
Demonstration	5 minutes	20
Report checking	5 minutes	35
Total Time/Max. Marks	30 minutes	100

Format of Certificate of Evaluation
Certificate of Evaluation (14 point, Times, Bold)

This is to certify that the undersigned have assessed and evaluated the project work titled "....." submitted by the following student(s).

- 1.
- 2.
- 3.

The project report has been accepted/ rejected for the partial fulfillment of B.Sc. programme.

Signature of the examiner
Name of the examiner

Stamp of the Department

8. Project Viva Voice

Student may be asked to write code for some segment of the problem during VIVA to check his coding capabilities. The project can be done in group of at most two or three students. A big project can be modularized and different modules can be assigned as separate project to different students.

9. Plagiarism

