SYLLABUS

FOR

BACHELOR OF COMPUTER APPLICATION(BCA)

COER SCHOOL OF MANAGEMENT

ROORKEE

Ordinance
for
Bachelor of Computer Applications (BCA) Programme

1. Admission

Admission to the BCA I[st] semester will be made as per rules prescribed by the Academic Council of the University or as per guidelines prescribed by the State Govt. from time to time.

2. Eligibility

Intermediate Mathematics.

3. Attendance

3.1 Every candidate is required to attend all the lectures, tutorials, practical and other prescribed curricular and co-curricular activities. It can be condoned up to 25% on medical grounds or for other genuine reasons.

3.2 A further relaxation of attendance up to 15% can be given by Principal/Dean/ Director of the Institute for the students, who have been absent with prior permission, for reasons acceptable to Head of the Institution/ College/ University.

3.3 No candidate will be allowed to appear in the end semester examinations if he/she does not satisfy the overall average attendance requirements as per clause 3.1 and clause 3.2.

4. Duration

4.1 Total duration of the BCA Course shall be three years, each year comprising two semesters.

4.2 Each semester shall normally have teaching for the 90 working days.

4.3 A student failing 2 times in I and / or II semester (of first year) and ineligible for the carry over system (clause 8) shall not be permitted to continue studies further.

4.4 Maximum time allowed for completing the BCA course will be 5 (five) years. Those who are unlikely to satisfy the condition shall not be allowed to continue the studies any further.

5. Curriculum

5.1 The 3 (Three) years curriculum will be divided into six semesters. Each semester include lectures, tutorials, practical and seminars as defined in the scheme of instructions and examinations.

5.2 It will also include co-curricular and extra curricular activities as prescribed from time to time by the Institute/college/university.

6. Examination

6.1 Student's performance will be evaluated through continuous assessment in the form of Class Tests, Assignments, Quizzes, Viva voce/Practical etc. There shall also be an examination at the end of each semester in theory subjects, practical and project.

6.2 The distribution of marks for the class tests, quiz test, assignments, end semester theory, practical, project, seminar and other examination shall be as per the prescribed scheme of examination.

6.3 The maximum marks for the theory subjects shall consist of marks allotted for end semester examination and sessional work.

6.4 The maximum marks for the practical shall consist of marks allotted for practical examination and sessional work.

6.5 Pass/fail in a subject shall be declared on the basis of total marks obtained in theory/practical examination and the sessional award for theory/practical subjects.

6.6 The minimum pass marks in the theory subjects (including sessional marks) shall be 40%.

6.7 The minimum pass marks in the practical subjects (including sessional marks) shall be 50%.

6.8 The marks of the previous semester(s) shall not be added in declaring the result of any semester examination.

6.9 To pass a semester candidate must secure 50% of aggregate marks in that semester.

6.10 No merit position shall be awarded to a candidate who has qualified for promotion to higher classes with back papers.

6.11 The student failing in the project only but satisfying all other requirements including obtaining 50% or more marks in aggregate will be allowed to submit a new / modified project at any time after three months of the declaration of result without repeating the whole session.

7. Promotion Rules

7.1 A candidate satisfying all the conditions under clause 6 shall be promoted to the next semester.

7.2 A candidate not satisfying the above conditions but failing in not more than 3 subjects (Theory and/or practical) of a semester examination shall be governed by the clause No. 8.

7.3 All other candidates will be required to repeat the semester either as regular candidate, after re-admission or opting for ex-studentship. This facility is however subject to the time limits stipulated in clause No. 4.

8. **Promotion under carry-over system**

8.1 A candidate who fails in the category of clause No. 7.2 shall become eligible for provisional promotion to next semester and the carry-over system as per the following table.

For promotion to & exam	Max. permitted no. of carry over subjects of semester					
	I	II	III	IV	V	VI
II	2	-	-	-	-	-
III	2	2	-	-	-	-
IV	2	2	2	-	-	-
V	-	-	2	2	-	-
VI	-	-	2	2	2	-

Admission to & Semester Exams. not Permitted	Carry over subjects not cleared of semester
V	I & II

8.2 No separate carry-over Examination will be held for any subject except for BCA Final year. Any candidate eligible for the carry-over system shall have to appear in the carry over subjects in the subsequent University Examination for the same semester.

9. Ex-studentship

Sessional marks in the subject of an ex-student shall remain the same as those secured by him/her earlier.

10. Result

Results at the end of final year will be declared with the following weightages:

I year	100%
II year	100%
III year	100%

11. Award of Division

11.1 If candidate passes all examinations in single attempt and secures 75% or more in aggregate marks he/she shall be placed in the First Division with Honours.

11.2 If candidate passes all examinations and secures aggregate marks of 60% or more but less than 75% **OR** greater than or equal to 75% after back in any examination, he/she shall be placed in First Division.

11.3 If candidate passes all examinations and secures aggregate marks of 50% or more but less than 60%, he/she shall be placed in Second Division.

12. **Seminar and Project**

12.1 Candidate must secure 50% marks to pass in seminar and project.

13. **Grace Marks**

A candidate shall be entitled to grace marks of a maximum of 5 in any one subject in a semester to enable him to pass, provided he is failing in only one subject and has secured the necessary minimum aggregate. The grace marks shall not be added to the marks of the subject or to the aggregate. The grace marks will not be awarded to enable a candidate to pass in a practical or project.

15. **Scrutiny shall be allowed as per the rules of the University.** Revaluation is not permitted.

Bachelor of Computer Application

Programme Structure

SEMESTER - I

BCA101 : Programming in 'C'

BCA102 : Fundamental of Computers

BCA103: Mathematical foundation of Computer Science

BCA104 : Business Communications

BCAP11 : Programming in 'C'

BCAP12 : PC Packages(Introduction to Operating system & MS Office)

SEMESTER - II

BCA201 : Data Structure & File Organization

BCA202 : Programming in C++

BCA203 : System Analysis and Design

BCA204 : Digital Electronics

BCAP21 : Data Structure & File Organization

BCAP22 : Programming in C++

SEMESTER - III

BCA301 : Computer Based Numerical Techniques

BCA302 : Data Base Management System

BCA303 : Theory of Computation

BCA304 : Organization Structure and Personnel Management

BCAP31 : Computer Based Numerical Techniques

BCAP32 : Data Base Management System

SEMESTER - IV

BCA401 : Operating system Organization & UNIX

BCA402 : Visual Basic Programming

BCA403 : Software Engineering

BCA404 : Data Communication & Computer Networks

BCAP41 : Operating System Organization & UNIX

BCAP42 : Visual Basic Programming

SEMESTER – V

BCA501 : Computer Graphics

BCA502 : Web Programming using JAVA

BCA503 : Management Information System

BCA504 : .Net Technology

BCAP51 : Programming in JAVA

BCAP52 : Net Technology

SEMESTER VI

BCA601 : .Net Framework

BCA602 : Network Security

BCAP61 : .Net Framework

BCASM : Seminar

BCAPR : Project

FIRST SEMESTER:

S. No	Course No.	Subject	Evaluation – Scheme							
			Period			Sessional			Examination	
			L	T	P	TA	CT	TOT	ESE	Sub. Total
Theory										
1.	BCA101	Programming in 'C'	3	1	-	10	20	30	70	100
2.	BCA102	Fundamental of Computers	3	1	-	10	20	30	70	100
3.	BCA103	Mathematical Foundation of Computer Science	3	1	-	10	20	30	70	100
4.	BCA104	Business Communication	3	1	-	10	20	30	70	100
Practical										
1.	BCAP11	Programming in 'C'	-	-	4	50	-	50	100	150
2.	BCAP12	PC Packages(Introduction to Operating system & MS Office)	-	-	4	50	-	50	100	150
		Total	12	4	8	-	-	220	480	700

Total Period = 24
Total Marks = 700

SECOND SEMESTER:

S. No	Course No.	Subject	Evaluation – Scheme							
			Period			Sessional			Examination	
			L	T	P	TA	CT	TOT	ESE	Sub. Total
Theory										
1.	BCA201	Data Structures	3	1	-	10	20	30	70	100
2.	BCA202	Programming in C++	3	1	-	10	20	30	70	100
3.	BCA203	System Analysis and Design	3	1	-	10	20	30	70	100
4.	BCA204	Digital Electronics	3	1	-	10	20	30	70	100
Practical										
1.	BCAP21	Data & File Structures	-	-	4	50	-	50	100	150
2.	BCAP22	Programming in C++	-	-	4	50	-	50	100	150
		Total	12	4	8	-	-	220	480	700

TA : Teacher Assessment
CT : Class Test
ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

Total Period = 24
Total Marks = 700

THIRD SEMESTER:

S. No	Course No.	Subject	Evaluation – Scheme							
			Period			Sessional			Examination	
			L	T	P	TA	CT	TOT	ESE	Sub. Total
Theory										
1.	BCA301	Computer Based Numerical& Statistical Techniques	3	1	-	10	20	30	70	100
2.	BCA302	Data Base Management System	3	1	-	10	20	30	70	100
3.	BCA303	Computer System Architecture	3	1	-	10	20	30	70	100
4.	BCA304	Organizational Structure & Personnel Management	3	1	-	10	20	30	70	100
Practical										
1.	BCAP31	Computer Based Numerical& Statistical Techniques	-	-	4	50	-	50	100	150
2.	BCAP32	Data Base Management System	-	-	4	50	-	50	100	150
		Total	12	4	8	-	-	220	480	700

Total Period = 24
Total Marks = 700

FOURTH SEMESTER:

S. No	Course No.	Subject	Evaluation – Scheme							
			Period			Sessional			Examination	
			L	T	P	TA	CT	TOT	ESE	Sub. Total
Theory										
1.	BCA401	Operating System Organization & UNIX	3	1	-	10	20	30	70	100
2.	BCA402	Visual Programming	3	1	-	10	20	30	70	100
3.	BCA403	Software Engineering	3	1	-	10	20	30	70	100
4.	BCA404	Multimedia Tools & Application	3	1	-	10	20	30	70	100
Practical										
1.	BCAP41	Operating System Organization & UNIX	-	-	4	50	-	50	100	150
2.	BCAP42	Visual Programming	-	-	4	50	-	50	100	150
		Total	12	4	8	-	-	220	480	700

Total Period = 24
Total Marks = 700

TA : Teacher Assessment
CT : Class Test
ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

FIFTH SEMESTER:

S. No	Course No.	Subject	Evaluation – Scheme							
			Period			Sessional			Examination	
			L	T	P	TA	CT	TOT	ESE	Sub. Total
Theory										
1.	BCA501	Computer Graphics	3	1	-	10	20	30	70	100
2.	BCA502	Web Programming using JAVA	3	1	-	10	20	30	70	100
3.	BCA503	Management Information System	3	1	-	10	20	30	70	100
4.	BCA504	.Net Technology	3	1	-	10	20	30	70	100
Practical										
1.	BCAP51	Programming in JAVA	-	-	4	50	-	50	100	150
2.	BCAP52	.Net Technology	-	-	4	50	-	50	100	150
		Total	14	4	8	-	-	220	480	700

Total Period = 24
Total Marks = 700

SIXTH SEMESTER:

S. No	Course No.	Subject	Evaluation – Scheme							
			Period			Sessional			Examination	
			L	T	P	TA	CT	TOT	ESE	Sub. Total
Theory										
1.	BCA601	.NET framework	3	1	-	10	20	30	70	100
2.	BCA602	Network Security	3	1	-	10	20	30	70	100
Practical										
1.	BCAP62	.NET framework	-	-	4	-	-	50	100	150
2.	BCASM	Seminar	-	-	2	-	-	-	50	50
3.	BCAPR	Project	-	-	10	-	-	-	100	100
		Total	6	2	16	-	-	110	390	500

TA : Teacher Assessment
CT : Class Test
ESE : End Semester Examination
SUB TOT. : Subject Total
TOT. : Total

Total Period = 24
Total Marks = 500

Note: The students with the help of the Institution may do summer training of 6-8 weeks duration, after II and IV Semester in an organization (academic or industrial) which will be submitted in the organization.

Each theory paper will of 100 marks comprising of 70 marks for University examination and 30 Marks for sessional. Each practical will be of 150 marks (100 marks of University examination and 50 Marks for sessional). The following in the distribution for marks (Semester wise):

	Theory	Practical	Total
1. Semester I	4x100	2x150	700
2. Semester II	4x100	2x150	700
3. Semester III	4x100	2x150	700
4. Semester IV	4x100	2x150	700
5. Semester V	4x100	2x150	700
6. Semester VI	2x100	1x150	350
6. Semester VI (a) Seminar (b) Project			 50 100
TOTAL			4000

BCA101 : **Programming in 'C'**

Programming in C: History, Introduction to C Programming Languages, Structure of C programs, compilation and execution of C programms. Debugging Techniques, Data Types and Sizes, Declaration of variables, Modifiers, Identifiers and keywords, Symbolic constants, Storage classes (automatic, external, register and static), Enumerations, command line parameters, Macros, The C Preprocessor

Operators: Unary operators, Arithmetic & logical operators, Bit wise operators, Assignment operators and expressions, Conditional expressions, precedence and order of evaluation. Control Statements: if-else, switch, break, continue, the comma operator, go to statement.

Loops: for, while, do-while.

Functions: built-in and user-defined, function declaration, definition and function call, parameter passing: call by value, call by reference, recursive functions, multifile programs.

Arrays: Linear arrays, multidimensional arrays, Passing arrays to functions, Arrays and strings.

Structure and Union: Definition and differences, self-referential structure. And address of (&) operator, pointer to pointer, Dynamic Momory Allocation, calloc and malloc functions, array of pointers, function of pointers, structures and pointers.

File: File Handling in C

References:

1. V. Rajaraman, "Fundamentals of Computers", PHI
2. Pater Norton's "Introduction to Computer", TMH
3. Hahn, "The Internet complete reference", TMH
4. Peter Nortton's, "DOS Guide", Prentice Hall of India
5. Gottfried, "Programming in C, Schaum's Series Tata McGraw Hill

BCA102 : Fundamental of Computers

Introduction to Computers: Computer hardware Components, Disk Storage, memory, keyboard, mouse, printers, monitors, CD etc., and their functions, Comparison Based analysis of various hardware components.

Basic Operating System Concepts: MS-DOS, WINDOWS, Functional knowledge of these operating systems. Introduction to Basic Commands of DOS, Managing File and Directories in various operating Systems, Introduction to internet, Basic terms related with Internet, TCP/IP.

Algorithm development, techniques of problem solving, flowcharting, stepwise refinement algorithms for searching, sorting (exchange and insertion), merging of ordered lists.

Programming : Representation of integer, character, real, data types, constraints and variables, arithmetic expressions, assignment statement, logical expression; sequencing, alteration and interaction, arrays, string processing sub programs, recursion, files and pointers.

Structured programming concepts : Top down design, development of efficient programs; Program correctness; Debugging and testing of programs.

Element of a computer processing system : Hardware CPU, storage devices and media, VDU, input-output devices, data communication equipment software-system software, application software.

Programming languages : Classification, machine code, assembly language, higher level languages, fourth generation languages.

References :

Raja Raman V : Fundamentals of Computers
Sanders D.H. : Computers Today

BCA103: Mathematical foundation of Computer Science

Relation: Type and compositions of relations, Pictorial representation of relations, Equivalence relations, Partial ordering relation.

Function: Types, Composition of function, Recursively defined function.

Mathematical Induction: Piano's axioms, Mathematical Induction, Discrete Numeric Functions and Generating functions, Simple Recurrence relation with constant coefficients, Linear recurrence relation without constant coefficients, Asymptotic Behaviour of functions

Algebric Structures: Properties, Semi group, monoid, Group, Abelian group, properties of group, Subgroup, Cyclic group, Cosets, Permutation groups, Homomorphism, Isomorphism and Automorphism of groups.

Prepositional Logic: Preposition, First order logic, Basic logical operations, Tautologies, Contradictions, Algebra of Proposition, Logical implication, Logical equivalence, Normal forms, Inference Theory, Predicates and quantifiers, Posets, Hasse Diagram.

References:

1. Liptschutz, Seymour, "Discrete Mathematics", TMH.
2. Trembley, J.P. & R. Manohar, "Discrete mathematical Structure with Application to Computer Science", TMH.
3. Kenneth H. Rosen, "Discrete Mathematics and its applications', TMH.
4. Doerr Alan and Levasseur Kenneth, "Applied Discrete Structure for Computer Science, Galgotia Pub. Pvt. Ltd.
5. Gersting "Mathematical Structure for Computer Science", WH freeman and Macmillan
6. Kumar Rajendra, "Theory of Automata: Languages and Computation", PPM
7. Hopcroft J.E. Uliman J.D., "Introduction to Automata Theory, Language and Computation" Narosa Pub. House, New Delhi.
8. C.L.Liu "Elements of Discrete Maehmatics", McGraw Hill.
9. Peter Grossman, "Discrete Mathematics for Computer", Palgrave Macmillian.

BCA104 : **Business Communications**

Perception, nature and importance, perceptual organization, perceptual interpretation, social perception motivation, characteristics of needs, models of motivation, theories of motivation.
Learning and behaviouristic theories, cognitive theories, social learning theories.

Personality, theories of personality, measurement of personality.

Communication : Fundamentals, downward and upward communication, other forms of communication. Attitudes nature effects, measurement and changing attitudes.

Fundamentals of Technical Communications, Oral Communication and Written Communication , Public Speaking, negotiations, Presentation skills, Transactional Analysis and Ego-states, Role of communication in IT.

BCA201 : Data Structure & File Organization

Introduction: Basic Terminology, Elementary Data Organization, Data Structure operations. Algorithm Complexity and Time-Space trade-off. Arrays: Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, Character String in C, Character string operation, Array as Parameters. Ordered list, Sparse Matrices, and Vector. Stacks: Array Representation and Implementation of stack, Operations and Stacks: Push and POP, Array Representation of Stack, Linked Representation of stack, Operations Associated with Stacks, Application of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Recursion: Recursive definition and processes.

Queues: Array and linked representation and implementation of queues, Operations on Queue; Create, Add, Delete, Full and Empty, Circular queue, Dequeue, and Priority Queue. Link List: Representation and implementation of Singly linked lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List of Array, Polynomial representation and addition, Generalized linked list, Garbage Collection and Compaction.

Trees: Basic terminology, Binary Tree, Binary tree representation algebraic Expressions, Complete Binary Tree, Extended Binary Tree, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees. Traversing Threaded Binary tree, Huffman algorithm. Searching and Hashing: Sequential search, comparison and analysis, Hash Table, Hash Function, Collection Resolution Strategies, Hash Table Implementation.

Sorting: Insertion Sort, Bubble sorting, Quick Sort, Two way Merge Sort, Trees: Binary Search (BST), Insertion and Deletion in BST.

References:

1. Horowitz and Sahani, "Fundamentals of data Structures" Galgotia
2. R. Kruse etal, "Data Structures and Program Design in C" Person Education
3. A.M. Tenenbaum etal, "Data Structures and Program Design in C" Person Education
4. Lipschutz, "Data Structure", TMH
5. K Loudon, "Mastering Algorithms With C", Shroff Publishers and Distributors
6. Bruno R Preiss, "Data Structure and Algorithms with Object Oriented Design Pattern in C++, Jhon Wiley & Sons, Inc.
7. Adm Frozdek, "Data Structures and Algorithms in C++" Thomson Asia
8. Pal G. Sorenson, "An Introduction to Data Structures with Application", TMH

BCA202 : **Programming in C++**

Introduction: Introduction to OOP, Basic Concepts of OOP, Applications of OOP. Introduction to C++, Introduction to C++ stream I/O, declarations in C++, Creating New data types in C++, function Prototypes, Inline functions, Reference Parameters, Const Qualifier, Dynamic memory allocation, default arguments, Unary Scope resolution operator, Linkage specifications.

Class, Constructors, Friend Class : Introduction, Comparing class with Structure, Class Scope, Accessing Members of a class, Constructor, Destructor, Const objects, Const member functions, Friend class, Friend function, This pointer, Data abstraction and Information hiding, container classes and iterators

Overloading & Inheritance: Operator Overloading, Fundamentals, Restrictions, Overloading stream, Insertion and stream extraction operators, Overloading unary & binary operators, Converting between types, Overloading ++ and --. Inheritance, Introduction, Protected members, Casting base _class pointers to derived _class pointers Overloading Base class members in a Derived class, Public, Protocols and Private inheritance, Direct base classes and Indirect Base Classes, Using Constructors and Destructors in Derived classes, Implicit Derived class object to base class object conversion.

Virtual Functions : Introduction, Type fields and switch statements, Virtual functions, Abstract base classes and concrete classes, Polymorphism, Dynamic binding, Virtual destructors.

C++ Stream I/O : Streams, Stream Input, Stream Output, Unformatted I/O, Stream manipulators, Stream format states, Stream error, States.

References:

1. Deitel H.M. & Deitel P.J. – "How to Program C++" – PHI – 2003
2. Al stevenes – "C++ Programming" – Wiley dreamtech – 2003.
3. Herbert Scheldt, "Complete Reference".
4. E. Balagurusamy "Object Oriented Programming with C++".
5. Yashwant Kanetkar, "Let Us C++".
6. C++ Programming by Herbert Scheldt – 2004.

BCA203 : System Analysis and Design

System Concepts and Information System Environment: The System Concept, Definition, Characteristics of Systems, Elements of a System, Open and Closed and closed system, Formal & Informal Information Systems, Computer based Information Systems, Management Information System, Decision Support System, General Business Knowledge, and Interpersonal Communicational System.

The System Development Life Cycle: Recognition of needs, Impetus for System Change, Feasibility Study, Analysis, Design, Implementation, Post implementation & Maintenance.

The Role of the Systems Analyst: Role of the Analyst, Analyst/User Interface, Behavioral issues.

Systems Planning & Initial Investigation: Strategies for Determining Information Requirement, Problem Definition & Project initiation, Background Analysis, Fact Analysis, Review of Written Documents, Onsite Observations, Interviews & Questionnaires, Fact Analysis, Performance Analysis, Efficiency Analysis, Service Analysis.

Information Gathering: Kind of Information needed. Information about the firms, Information gathering tools, the art of Interviewing, Arranging the Interview, Guides to Successful Interview, Types of Interviews and Questionnaires, The Structured and Unstructured Alternatives.

The Tools of Structured Analysis: The Dataflow Diagram (DFD), Data Dictionary, Decision Trees and Structured English.

Feasibility Study: System performance, Economic Feasibility, Technical Feasibility, Behavioral Feasibility, Steps in Feasibility Analysis.

Input/Output and Forms Design: Input Design, CRT Screen Design, Output Design, Requirements form Design.

References:

1. Elias M.Awad, "Systems Analysis & Design" Galgotia Publication
2. Hoffer, "Modern Systems Analysis & Design" Addision Wesley
3. Kendall, "Introduction to System Analysis & Desogm", McGraw Hill

BCA204 : **Digital Electronics**

Representation of information & Basic Building Blocks: Introduction to Computer, Computer hardware generation, Number System: Binary, Octal, Hexadecimal, Character Codes (BCD), ASCII, EBCDIC and their conversion. Logic gates, Boolean Algebra, K-map simplification, Half Adder, Full Adder, Subtractor, Decoder, Encoders, Multiplexer, Demultiplexer.

Basic Organization: Operational flow chart (Fetch, Execute, Instruction Cycle), Organization of Central Processing Unit, Hardwired & micro programmed control unit, Single Organization, General Register Organization, Stack Organization, Addressing modes, Instruction formats, data transfer & Manipulation, I/O Organization, Bus Architecture, Programming Registers.

Memory Organization: Memory hierarchy, Main memory (RAM/ROM) chips), Auxiliary memory, Associative memory, Cache memory, Virtual memory, Memory Management Hardware, hit/miss ratio, magnetic disk and its performance, magnetic Tape etc.

I/O Organization: Peripheral devices, I/O interface, Modes of Transfer, Priority Interrupt, Direct Memory Access, Input-Output Processor, and Serial Communication. I/O Controllers, Asynchronous data transfer.

References:

1. Willam Stalling, "Computer Organization & Architecture" Pearson Education Asia
2. Mano Morris, "Computer System Architecture" PHI
3. Zaky & Hamacher, "Computer Organization: McGraw Hill
4. B. Ram, "Computer Fundamental Architecture & Organization" New Age
5. Tannenbaum, "Structured Computer Organization" PHI.

BCA301 : **Computer Based Numerical Techniques**

Floating point Arithmetic: Representation of floating point numbers, Operations, Normalization, Pitfalls of floating point representation, Errors in numerical computation. Iterative Methods: Zeros of a single transcendental equation and zeros of polynomial using Bisection Method, Iteration method, Regula-Falsi method, Newton Raphson method, Secant method, Rate of convergence of iterative methods.

Simultaneous Linear Equations: Solutions of system of Linear equations, Gauss Elimination direct method and pivoting, III conditioned system of equations, Refinement of solution. Gauss Seidal iterative method, Rate of Convergence. Interpolation and approximation: Finite Differences, Difference tables. Polynomial Interpolation: Newton's forward and backward formula Central Difference Formulae: Gauss forward and backward formula, stirling's Bassel's Everett's formula. Interpolation with unequal intervals: Language's Interpolation, Newton Divided difference formula.

Numerical Differentiation and Integration: Introduction, Numerical Differentiation, Numerical Integration, Trapazoidal rule, Simpon's rules, Boole's Rule Euler-Maclaurin Formula Solution of Differential Equations: Picard's Method, Euler's Method, Taylor's Method, Runge-Kutta methods.

References:

1. Rajaraman V., :Computer Oriented Numerical Methods". PHI
2. Gerald and Wheatley, "Applied Numerical Analyses", AW
3. Jain, Lyengar and Jain, "Numerical Methods for Scientific and Engineering Computations:, New Ager Int.
4. Grewal B.S., "Numerical methods in Engineering and Science. Khanna Publishers, Delhi.
5. T.Veerarajan, T Ramchandran, "Theory and Problems of Numerical Methods", TMH

BCA302 : Data Base Management System

Introduction: An overview of database management system, Database System Vs File System. Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML. Overall Database structure. Data modeling using the Entity Relationship Model: ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model, relationships of higher degree.

Relational Data Model and Language: Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra, relational calculus, tuple and domain calculus.

Introduction to SQL: Characteristics of SQL, Advantages of SQL, SQL data types and literals, Types of SQL commands, SQL operators and their procedure, Tables, views and indexes Queries and sub queries, Aggregate functions, Insert, update and delete operations, Joints, Unions, Intersection, Minus, Cursors in SQL. PL/SQL, Triggers and clusters.

Database Design & Normalization: Functional dependencies, normal forms, first, second third normal forms, BCNF, inclusion dependencies, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design

References:

1. Date C.J. "An Introduction to Database System". Addision Wesley
2. Korth, Silbertz, Sudarshan, "Database Concepts" McGraw Hill
3. Elmasri, Navathe, "Fundamentals of Database Systems" Addision Wesley
4. Paul Beynon Davis, "Database Systems" Palgrave Macmillan
5. Bipin C. Desai, "An introduction to Database Systems", Galgotia Pub.

BCA303 : Theory of Computation

A brief review of Finite Automata, Regular expressions, Regular languages, Deterministic and non-deterministic computations. Pumping Lemma for Regular languages, Context free languages, Pushdown automaton, Pumping Lemma for Context free languages, Grammar types and Chomsky Hierarchy. Turing Machines (TM), Variations of TM's, Universal Turing Machines (UTM), Church-Turing Thesis, Relation of Languages to Automata. Turing computable functions, Halting problem, Solvability, Undecidability and Computability.

References:

1. J.E.Hopcraft, R. Motwani and J.D. Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education
2. Cohen, "Introduction to Computer Theory", John Wiley.
3. M. Sipser, Introduction to Theory of Computation, PWS Publishing Corporation, 1997.
4. J.E. Hopcroft, J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Addison-Wisley, 1979.
5. T.C. Martin, Theory of Computation, Tata McGraw-Hill
6. H.R. Lewis, C.H. Papadimitrou, Elements of the Theory of Computation, PHI.

BCA304 : Organization Structure and Personnel Management

Organization Structure: Classical theories of Management: Scientific management theory, Fayol's 14 principles of Management Webar's bureaucratic theory. Definition of organization and organization Structure.

Some Concepts Regarding Organization Structure: Line and Staff authority, Centralization and Decentralization, Span of control, Formal and Informal Organization.

Forms of Organization Structure and Feature: Function bases, Product bases, Geography based, Project based (Matrix). Organization Design: Mechanistic and Organic Structure, Virtual and Network organization Structure.

Motivation: Definition of Motivation, Importance of Motivation, Motivation and behaviour, Theories of Motivation - Maslows need Hierarchy, Two-Factor Theory, McClelland's Need Theory, Theory X and Theory Y.

Nature and Scope of Human Resource Management: Scope of HRM, HRM-function and objectives, HRM model.

Personnel Function: Personnel polices and principles, duties and responsibilities of personnel manager, differences between HRM and PM Emerging trends of personnel management in India

Human Resource Planning: Meaning, definition and importance of HRP. Job Analysis: Meaning and definition, process of job analysis Recruitment: Meaning and definition, importance, sources of recruitment. Indian scenario. Selection: Meaning and definition, selection process, types of interview.

Training and Development: Nature of training and Development, Inputs in training and Development, importance of training and Development, training process, training of International assignment.

References:

1. L.M. Prasad "Organizational Behavior", S.Chand
2. V.S.P. Rao, P.S. Narayana, "Organizational Theory and Behaviour" Konark Publishers Pvt. Ltd.
3. Tripathi, Reddy, "Principles of Management:. TMH
4. Koontz, Weihrich, "Essentials of Management:, TMH
5. Fred Luthans, :Organizational Behaviour", McGraw Hill
6. K. Aswathappa, "Human Resources and Personnel Management", TMH
7. L.M. Prasad, "Human Resource management", S.Chand.

BCA401 : Operating system Organization & UNIX

Operating system- definition, simple batch system, Time sharing system, Real time system, storage hierarchy, operating system service.

Process concept, process Scheduling, operating on process, co-operating process.

CPU Scheduling concepts, Scheduling algorithms, process synchronization, critical section problem, synchronization hardware, semaphores.

Deadlocks, deadlock characterization, deadlock prevention, avoidance detection and recovery.

Storage management Resident monitor, Logical versus physical address space, swapping, and segmentation, SCM.

Virtual memory, Demand paging, page replacement and page replacement algorithms, allocation of frames, thrashing.

File System: File supports, access methods, allocation methods-contiguous, linked and index allocation, directory system – single level, tree structured, acyclic graph and general graph directory, file protection.

Secondary storage structure: Disk structures, disk scheduling disk management, allocation methods, free space management.

Case study of the UNIX system: design principles, programmer and user interface, process, memory and file management.

References:

1. Peterson Abraham & Silbesschatz, Peter Galvin: Operating system concepts.
2. Mandnick and Donovan : Operating system (Mc–Graw Hill) 1996.
3. Tanenbaum A.S. : Modern Operating system, (PHI) 1998.
4. Growley, : Operating system a design Approach .

BCA402 : Visual Basic Programming

Introduction : What is Visual basic; Features of Visual Basic; Visual basic Editions; The Visual Basic Philosophy; The Controls; The Properties; Events; Methods; Developing an Application; Design the User Interface; Write Code to Respond to User Input/Events

Creating an Application : The Tool Box; Project Explorer; The Properties Window; The Form Window; Saving the Project; Understanding Projects; What does Visual Basic 6 have for you to create applications; Customizing this Toolbar, Text Box Control; The Picture Box; Label Box; Option Button; Frame; List Box; Combo Box; Data; Command Button; Check Box; The Drive, Directory and File List Controls; The Line and Shape Controls; The Image Control; OLE(Object Linking and Embedding); Other Tools for Software Development; Menu Bar; Context Menus; Tool Bars; Tool Box; Project Explorer Window; Properties Window; Object Browser; Form Designer; Code Editor Window; Form Layout Window; Immediate, Locals, and Watch Windows

IDE, Forms and Controls : The Form; The Anatomy of a Form; Setting Form Properties; Working with the Properties Window; Name; Caption; Picture; Background Color; The Control Box; Min Button and Max Button; Movable; Border Style; Font Properties; Form Methods; Move; Graphic Methods; Show Methods; Initialize; Load; Activate; Deactivate; Unload Event; Terminate; Show Method; Show Style; Hide Method; How Do You Put or Create the Control on the Form; Working with a Control; More work on a Control; The Code Window; Opening the Code Window; Anatomy of the Code Window; Now Entering the Code.

Variables: What is a Variable; Declaring variables; Data Types; The Null Value; The error Value; The Empty Value; The Scope of a Variable; Module Level Variable; Declaring Variable; Constants; Circular References; Converting Data Types; Arrays, How do you Define them; Declaring Fixed-Size Arrays; Multi-dimensional arrays; Dynamic arrays; The Preserve Keyword.

Writing Code in Visual Basic : The Code Window; Opening the Code Window; Parts of the Code Window; Object Box; Procedures/Events Box; Split Bar; Margin Indicator Bar; Procedure View Icon; Full Module View Icon; The Procedure Separator; The Anatomy of a Procedure; Subroutine or Function; Editor Features; Automatic Word Completion; Auto List Members; Color Cueing; Line Continuation Character; Commenting and Uncomment Statements; The For. Next Statement; The Decision Maker. If; The Loop; The While Loop; Select Case…End Select

Menus': Building the User Interface. The First Step; Overcrowding; Important Information Must be Given Prominence; Consistency; The Fonts; Consistency Across Forms and the Application; Affordances; Simplicity; Usability; Images; Colors; Interacting With the user; All about Menus; The Menu system; Menu Conventions; The Menu Editor; Using the Menu Editor; Making the Menu Better; Coding the Menu Items; Adding the Toolbar; Toolbar Conventions; Pasting Icons on Buttons

Multiple Document Interface Applications : Why MDI Forms; Features of an MDI Form; Loading MDI Forms and Child Forms; The Active Form Property; Changing the Caption of the New Forms; Listing Open Forms; Saving your work; Specifying the Active Child Form or Control; Maintaining State Information for a Child Form; Unloading MDI Forms with Query Unload

Additional Controls Available in Visual Basic 6.0 : Objectives; The Image List control; Working with the Image List Control; Adding Images to the Image List; Tab strip Control; Creating Tabs at Design Time or Run Time; Associating the Image List Control with the Tab Strip Control; MSFlexGrid Control; The Status Bar Control; The Panel Object and the Panels Collection; Tree View Control; Creating a Tree View control; Working with the Tree View control; Displaying Data from a Database; Populating the Tree View control; Slider Control;

ActiveX Data Objects : Objectives; Why ADO; OLE DB; ADO; Establishing a Reference; The Data Source; The ODBC Data Source Administrator; Using the Data Source name in Our Control; Table or Stored Procedure; Using Bound Controls; Updating the data in the Data Source; What is a Cursor

Crystal and Data Reports : Crystal Reports; Prerequisites for working with Crystal reports; Creating a Report through a Wizard; Creating a Report without a Wizard; The Design/Preview Window; Data Report; Getting acquainted with the Data Report Designer; Parts of the Data Report; Data Report Controls; Extracting the Data; Creating Multiple Reports

BCA403 : Software Engineering

Introduction: Introduction to software engineering, Importance of software, evolving role of software, Software Characteristics, Software Components, Software Applications, Software Crisis, Software engineering problems, Software Development Life Cycle, Software Process.

Software Requirement Specification: Analysis, Principles, Water Fall Model, The Incremental Model, Prototyping, Spiral Model, Role of management in software development, Role of matrices and Measurement, Problem Analysis, Requirement specification, Monitoring and Control.

Software-Design: Design principles, problem partitioning, abstraction, top down and bottom up-design, Structured approach functional versus object oriented approach, design specifications and verification, Monitoring and control, Cohesiveness, coupling, Forth generation techniques, Functional independence, Software Architecture, Transaction and Transaction and Transform Mapping, Component level Design, Forth Generation Techniques.

Coding: Top-Down and Bottom-Up programming, structured programming, information hiding, programming style and internal documentation.

Testing principles, Levels of testing, functional testing, structural testing, test plane, test case specification, reliability assessment, software testing strategies, Verification and validation, Unit testing, Integration Testing, Alpha & Beta testing, system testing and debugging.

Software Project Management: The Management spectrum (The people, the product, the process, the project) Cost estimation, project scheduling, staffing, software configuration management, Structured Vs. Unstructured maintenance, quality assurance, project monitoring, risk management.

Software Reliability & Quality Assurance: Reliability issues, Reliability metrics, Reliability growth modeling, Software quality, ISO 9000 Certification for software industry, SEI capability maturity model, comparison between ISO & SEI CMM. CASE (Computer Aided Software Engineering): CASE and its scope, CASE support in software life cycle, documentation, project management, internal interface, Reverse Software Engineering, Architecture of CASE environment.

References:

1. Pressman, Roger S., "Software Engineering: A Practitioner's Approach Ed. Boston: McGraw Hill, 2001
2. Jalote, Pankaj, "Software Engineering Ed.2"New Delhi: Narosa 2002
3. Schaum's Series, "Software Engineering" TMH
4. Ghezzi Carlo and Others "Fundamentals of Software Engineering" PHI
5. Alexis, Leon and Mathews Leon, "Fundamental of Software Engg.
6. Sommerville, Ian, "Software Engineering" AWL
7. Fairly, "Software Engineering" New Delhi" TMH
8. Pfleerger, S. "Software Engineering" Macmillan, 1987

BCA404 : Data Communication & Computer Networks

Introduction to Computer Networking: Use, advantage, structure of the communications network topologies the telephone network, analog to digital communication.

Communication Between Analog Computers & Terminals Layered Protocols, Network & The OSI Models. Traffic control and accountability wide area and local area networks, connection oriented and connectionless networks, classification of communication protocols polling/selection systems, non-priority system priority system, rotation for layered protocols foals of layered protocols, network design problems, communication between layers, A parametric illustration, introduction to standards organizations and the ISO standard.

Polling/Selection, Satellite and Local area Networks: Binary synchronous control, other BSC system, conversion using satellite communication SPUS, and the Tele-port primary attribute of a LAN, IEEE LAN standards, LAN topology and protocols.

Switching and routing in Network: Telephone switching system, message switching, packet switching, packet switching support to circuit switching networks.

The X.25 & Digital Networks: Layers of x.25, features of x.25 flow control principles, other packet type, x.25 logical channel states time out and time limits, packet formats, flow control and windows x.25 facilities, other standards layer the pad, communication networks communication between layers, advantage of digital networks, Digital's switching, voice transmission by packet.

Personal Computer Network: Personal computer communications, characteristics, using the personal computers as server linking the personal computer to mainframe computers, semaphores of vendor offerings. File transfer on personal computers, personal computer and local area networks. Personal computer networks and the OSI models.

TCP/IP: TCP/IP and internetworking, example of TCP/IP operations, related protocols ports and sockets. The IP address structure, major features of IP, IP datagram, Major IP services. IP source routing, value of the transport layer, TCP, Major features of TCP, passive and active operation, the transmission control block (TCB), route discovery protocols, examples of route discovery protocols, application layer protocols.

References:

1. Tannanhaum, A.S. : Computer Network, PHI – 1995.
2. Martin J.: Computer Network and Distributed processing, 1985.
3. Black : Computer Network; Protocols, Standards and Interface PHI – 1995.
4. Black : Data Network; Concepts, Theory and Practices, PHI
5. Starlings, William : Local Networks; and Introduction Mack Publishing Co.
6. Comer; Internetworking : Principles, Protocols Architecture, PHI with TCP/IP
7. Crichlow : Introduction to Distributed and Parallel Comp.
8. Ahuja : Design and Analysis of Computer Communication Network, McGraw Hill Co.
9. Chorafas: Designing and Implementing Networks, McGraw Hill Co.

BCA501 : Computer Graphics

Graphics Primitives: Display Devices: Refresh Cathode Ray Tube, Raster Scan Display, Plasma display, Liquid Crystal display Plotters, Printers. Input Devices: Keyboard, Trackball, Joystick, Mouse, Light Pen, Tablet, and Digitizing Camera.

Input Techniques: Positioning techniques, Potentiometers, Constraints, Scales & Guidelines, Rubber-Band techniques, Dragging Dimensioning techniques and Graphical Potentiometers. Pointing and Selection: the use of selection points defining a boundary rectangle, multiple selections, Menu selection.

Mathematics for Computer Graphics: Point representation, Vector representation, Matrices and operations related to matrices, Vector addition and vector multiplication, Scalar product of two vectors, Vector product of two vectors.

Line Drawing Algorithms: DDA Algorithms, Bresenham's Line algorithm.

Segment & Display files: Segments, Functions for segmenting the display file, Posting and posting a segment, segment naming schemes, Default error conditions, Appending to segments, Refresh concurrent with reconstruction, Free storage allocation, Display file structure.

Graphics Operations: Clipping, Point Clipping, Line Clipping, Polygon Clipping. Filling: Inside Tests, Flood fill algorithm, Boundary-Fill Algorithm and scan-line polygon fill algorithm.

Conics, Curves and Surfaces: Quadric surfaces: Sphere, Ellipsoid, and Torus. Superquadrics: Superellipse, superellipsoid, Spline & Bezier Representations: Interpolation and approximation splines, parametric continuity conditions, Geometric Continuity Conditions, Spline specifications. Bezier curves and surfaces.

Transformation: 2D transformation, Basic Transformations, Composite transformations: Reflection, Shearing, Transformation between coordinate systems. 3D Graphics: 3D Display Methods, 3D transformations, Parallel projection, Perspective projection, Visible lines and surfaces identification, Hidden surface removal.

Animation: Introduction to Animation to Animation, Principles of Animation, Types of Animation, Types of Animation Systems: Scripting, Procedural, Representational, Stochastic, etc. Animation Tools: Hardware-SGI, PC's Amiga etc.

References:

1. Donald Hearn and M Pauline Baker, "Computer Graphics" PHI
2. Steven Harrington, "Computer Graphics: A Programming Approach" TMH
3. Prajapati A.K. "Computer Graphics" PPM Ed2
4. Foley James D, "Computer Graphics" AW Ed2
5. Newman and Sproull, "Principle of to Interactive Computer Graphics" McGraw Hill
6. Rogers, "Procedural Elements of Computer Graphics", McGraw Hill
7. Rogers and Adams, "Mathematical Elements of Computer Graphics" McGraw Hill

BCA502 : Web Programming using JAVA

Internet-Beginning and current state, hardware and software requirements, ISP and Internet accounts, Web Home page, URI, Browser, Security on Web, Plums and helpers, searching tools and search engine FTP, Gopher, Telnet and e-mail.

Web Authoring using HTML : Creating a Web page, methods of Linking, Publishing, HTML, Text formatting and alignment, Font control, Arranging text in lists, Images on a web page, Backgrounds and colour control, Interactive layout with Frames.

History of the web, Growth of the Web, Protocols governing the web, Introduction to Cyber Laws in India, Introduction to International Cyber laws, Web project, Web Team, Team dynamics.

Communication Issues, the client, Multi-departmental & Large scale Websites, Quality Assurance and testing, Technological advances and Impact on Web Teams.

HTML: Formatting Tags, Links, List, Tables, Frames, forms, Comments in HTML, DHTML. Java Script: Introduction, Documents, Documents, forms, statements, functions, objects in Java Script, Events and Event Handling, Arrays, FORMS, Buttons, Checkboxes, Text fields and Text areas.

XML: Introduction, Display and XML Documents, Data Interchange with an XML document, Document types definitions, Parsers using XML, Client-side usage, Server Side usage.

Common Gateway Interface (CGI), PERL, RMI, COM/DCOM, VBScript, Active Server Pages (ASP).

References:

1. Burdman, "Collaborative Web Development", Addison Wesley
2. Sharma & Sharma, "Developing E-Commerce Sites" Addison Wesley
3. Iva Bayross, "Web Technologies Part-II" BPB Publications
4. Shishir Gundavarma, CGI Programming on the World Wide Web" O'Reilly & Associate
5. DON Box, "Essential COM" Addison Wesley
6. Greg Buczek, " ASP Developer's Guide" TMH

BCA503 : Management Information System

Fundamentals of Information Systems, Systems approach to problem solving, Developing information system solutions, Levels of MIS (Top, Middle, Lower).

Corporate Databases & Database Management, Data Organization, Data models, Data Security & Information quality.

Transaction Processing Systems, Executive Information Systems, Decision Support Systems, Expert Systems, Information Systems in Marketing, Manufacturing, HRM, Accounting and Finance.

Information Resource Management, Planning Implementing & Controlling Information Systems, Computer Crime, Ethics & Society.

References:

1. Brein James O. – Management Information Systems
2. Murdick & Ross – Information Systems for Modern Management
3. Parker C.S. – Management Information Systems – Strategy and Action.
4. Aktas A.Ziya – Structured Analysis and Design of Information Systems.

BCA504 : .Net Technology

Introduction to .NET: Writing Window Applications, Windows Graphical User Interface, Programming Languages – Procedural, Event Driven, and Object Oriented, The Object Model, Microsoft's Visual Studio.NET, Writing Visual Basic Projects, Three-Step Process, Visual Basic Application Files.

Visual Studio Environment: IDE Start Page, New Project Dialog, IDE Main Window, Toolbars, Document Window, Form Designer, Solution Explorer Window, Properties Window, Toolbox, Design Time, Run Time, and Break Time.

Writing Visual Basic Project: Workspace Setup, Plan the Project, Define the User Interface, Set Properties, Coding, Testing, Maintenance, Printing.

Finding and Fixing Errors: Syntax Errors, Run-Time Errors, Logic Errors, Project Debugging, Naming Rules and Conventions for Objects.

VARIABLES, CONSTANTS AND CALCULATIONS: Data: Variables and Constants, Formatting Data, Handling Exceptions, Displaying Messages in Message Boxes, Counting and Accumulating Sums, DECISIONS AND CONDITIONS, MENUS, SUB PROCEDURES, AND FUNCTIONS, LISTS, LOOPS, AND PRINTING, GRAPHICS, ANIMATION, AND ADDITIONAL TOPICS IN VISUAL BASIC.

BCA601 : .Net Framework

Introduction: .NET Lesson Introduction, Characterize the .NET Paradigm, Web Services, Framework Components, Common Language Runtime (CLR), Compare the .NET Class Framework to a Language-Specific Class Library, .NET Windows Forms, Console Applications.

Managing .NET: Common Language Runtime Components, Components of the CLR, Microsoft Intermediate Language (MSIL), .NET Compilers, Multiple Language Support in .NET, Cross-Language Interoperability, Garbage Collection, Structured Error-Handling.

Unifying .NET : The Class Framework, .NET Class Framework, Purpose of Namespaces, Inheritance, Interface and Inheritance-Based Polymorphism, Overloading, .NET Applications, Component Deployment, DLL Hell, Assembly, Simple .NET Application, Compile and Debug.

BCA602 : Network Security

Introduction To security: Attacks, Services & Mechanisms, Security, Attacks, Security Services, Conventional Encryption: Classical Techniques, Conventional Encryption Model, and steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Differential & Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operations.

Conventional Encryption Algorithms: Triples DES, Blowfish, International Data Encryption Algorithm, RCS, CAST-128, CR2 Placement & Encryption Function, Key Distribution, Random Number Generation, Placement of Encryption Function.

Hash Functions: Message Authentication & Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function & MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA), Digital Signatures: Digital Signature, Authentication Protocol, Digital Signature Standard (DDS) Proof of Digital Signature Algorithm.

Network & System Security: Authentication Applications: Kerberos X-509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP),S/Mine Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management.

References:

1. William Stallings, "Cryptography and Network Security: Principles and Practice'" Prentice hall, New Jersey
2. Johannes A. Buchmann, "Introduction to Cryptography" Springer-Verlag
3. Atul Kahate, "Cryptography and Network Security" TMH