Babu Banarasi Das University, Lucknow
School of Computer Applications
Bachelor of Computer Applications
Evaluation Scheme

SEMESTER I

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
Theory									
F	BCA2101	Computer Fundamental	3	1	0	40	60	100	4
C	BCA2102	Programming Concept Using 'C'	3	1	0	40	60	100	4
F	BCA2103	Digital Electronics	3	1	0	40	60	100	4
C	BCA2104	Mathematics I	3	1	0	40	60	100	4
C	BCA2105	Professional Communication	3	1	0	40	60	100	4
Practical									
C	BCA2151	'C' Programming Lab	0	0	4	40	60	100	2
C	BCA2152	Digital Electronics Lab	0	0	4	40	60	100	2
C	BCA2153	Seminar/Term Paper	0	0	2	100	0	100	1
	GP2101	General Proficiency	-	-	-	-	-	100	1
		Total	15	5	10			900	26

SEMESTER II

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
Theory									
C	BCA2201	Data Structure Using 'C'	3	1	0	40	60	100	4
C	BCA2202	Operating System	3	1	0	40	60	100	4
C	BCA2203	System Analysis & Design	3	1	0	40	60	100	4
F	BCA2204	Mathematics II	3	1	0	40	60	100	4
C	BCA2205	Computer Organization & Architecture	3	1	0	40	60	100	4
Practical									
C	BCA2251	Data Structure Using 'C' Lab	0	0	4	40	60	100	2
C	BCA2252	Computer Organization Lab	0	0	4	40	60	100	2
C	BCA2253	Seminar/Term Paper	0	0	2	100	0	100	1
	GP2201	General Proficiency	-	-	-	-	-	100	1
		Total	15	5	10			900	26

SEMESTER III

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
Theory									
C	BCA2301	Design & Analysis of Algorithm	3	1	0	40	60	100	4
C	BCA2302	Data Base Management System	3	1	0	40	60	100	4
C	BCA2303	Object Oriented Programming Using C++	3	1	0	40	60	100	4
C	BCA2304	Computer Communication & Computer Networks	3	1	0	40	60	100	4
C	BCA2305	Discrete Mathematics	3	1	0	40	60	100	4
Practical									
C	BCA2351	Data Base Management System Lab	0	0	4	40	60	100	2
C	BCA2352	Object Oriented Programming Using C++ Lab	0	0	4	40	60	100	2
C	BCA2353	Seminar/Term Paper	0	0	2	100	0	100	1
	GP2301	General Proficiency	-	-	-	-	-	100	1
		Total	15	5	10			900	26

SEMESTER IV

Course Category	Course Code	Course Title	L	T	P	CIA	ESE	Course Total	Credits
Theory									
C	BCA2401	Unix & Shell Programming	3	1	0	40	60	100	4
C	BCA2402	Numerical & Statistical Techniques	3	1	0	40	60	100	4
C	BCA2403	Internet & Java Programming	3	1	0	40	60	100	4
C	BCA2404	Software Engineering	3	1	0	40	60	100	4
C	BCA2405	Environmental Studies	2	0	0	40	60	100	2
Practical									
C	BCA2451	Unix & Shell Programming Lab	0	0	4	40	60	100	2
C	BCA2452	Internet & Java Programming Lab	0	0	4	40	60	100	2
C	BCA2453	Seminar/Term Paper	0	0	2	100	0	100	1
	GP2401	General Proficiency	-	-	-	-	-	100	1
		Total	14	4	10			900	24

The column headers for Contact Hours are L, T, P and for Evaluation Scheme are CIA, ESE, Course Total.

SEMESTER V

Course Category	Course Code	Course Title	Contact Hours			Evaluation Scheme			Credits
			L	T	P	CIA	ESE	Course Total	
Theory									
C	BCA2501	.Net Framework & C#	3	1	0	40	60	100	4
C	BCA2502	Web Application Development	3	1	0	40	60	100	4
GE		Generic Elective	3	1	0	40	60	100	4
C	BCA2504	Management Information Systems	3	1	0	40	60	100	4
OE		Open Elective	3	1	0	40	60	100	4
Practical									
C	BCA2551	.Net Framework & C# Lab	0	0	4	40	60	100	2
C	BCA2552	Web Application Development Lab	0	0	4	40	60	100	2
C	BCA2553	Seminar/Term Paper	0	0	2	100	0	100	1
	GP2501	General Proficiency	-	-	-	-	-	100	1
		Total	15	5	10			900	26

Course Category	Course Code	Course Title	Evaluation Scheme			Credits
			CIA	ESE	Course Total	
C	BCA2651	Industrial Training-cum-Project	320	480	800	25
	GP2601	General Proficiency	-	-	100	1
		Total			900	26

SEMESTER VI

Legends:

L Number of Lecture Hours per week
T Number of Tutorial Hours per week
P Number of Practical Hours per week
CIA Continuous Internal Assessment
ESE End Semester Examination

Credit Summary Chart

Course Category	Semester						Total Credits	%age
	I	II	III	IV	V	VI		
Basic Sciences	4	4					8	5
Humanities	4			2			6	3.8
Social Sciences								
Professional Subject - Core	17	21	25	21	17		101	66.2
Professional Subject – Generic Elective					4		4	2.5
Professional Subject – Open Elective					4		4	2.5
Project Work, Seminar and/or Internship in Industry or elsewhere	1	1	1	1	1	26	31	20
Total	26	26	26	24	26	26	154	100

Category of Courses:
F   Foundation Course
C   Core Course
GE   Generic Elective
OE   Open Elective

Discipline wise Credit Summary Chart

Course Category	Semester						Total Credits	%age
	I	II	III	IV	V	VI		
F	8	4					12	7.7
C	18	22	26	24	18	26	134	87.3
GE					4		4	2.5
OE					4		4	2.5
Total	26	26	26	24	26	26	154	100

Generic Elective Subjects List

1. BCA2511 Fundamental of E Commerce
2. BCA2512 Computer Graphics
3. BCA2513 Green Computing
4. BCA2514 E- governance

Open Elective Subjects List

1. BCA2515: Environmental Issues of IT & e-Waste Management
2. BCA2516: Digital Governance

BCA2101: Computer Fundamental
Course Objective:

1. The subject provide the fundamental concepts of computer science and information technology.
2. Subject introduces computer hardware, computer networks, DBMS and operating system.

Learning Outcome: Upon successful completion of the course the student will Be able to:

1. Understand the basics of computer science and information technology.
2. Learn History of computers, Computer Peripherals, Storage Devices, Computer Security Systems, Computer Viruses and Computer Networking etc.
3. Understand how to use Internet technology and their various applications.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Evolution of Computer, Number System, CPU & Memory Unit:** Evolution of Computer: Introduction to computer, Basics of computers and its operation, History of computer, Capabilities and limitations of computers, Types of computers; Data Representation: Number System, Arithmetic operations in binary numbers, ASCII & EBCDIC character sets, BCD codes; Central Processing Unit: The internal Architecture of CPU, Introduction to microprocessors, Commonly used CPUs and CPU related Technology; Storage Devices and media: Primary & Secondary Memories, Memory Hierarchy, Cache Memory, Auxiliary Storage Devices.	30 Hours	1
II	**Input/output devices:** Input output devices: Input device , Pointing devices or Graphic Input devices, Off line Input devices; **Computer Output Units**: Monitors, Various Types of Monitors, Printers, Plotters, Optical Recognition System, Pen based , systems, Digitizer, MICR, OCR, OMR, Bar-code Reader, Digital Camera Role of Interface; Input/output Bus system; Interaction with memory organization.	30 Hours	1
III	**Operating System** Operating System: Types of Operating System, Function of Operating System, MS-DOS, Internal Commands & External Commands; Types of Compilers: Interpreter, Compiler, Translator, Assembler; Booting: Soft Booting, Hard Booting; Buffering and Spooling ; Software concepts: Types of software, Programming languages, Computer Virus: Types of Viruses, Anti-Virus Software.	30 Hours	1

	Computer Networks & Internet		
IV	Data communication ,Modulation, Network Devices, Types of network, Switching Techniques, Internet and protocol , Internet services, Data transmission Mode, Transmission media, OSI reference model	30 Hours	1

Suggested Readings:

1. Fundamentals of Computers & Programming with C, Sharma A.K, DRP Publication.

2. Fundamentals of computers, Raja Raman .V, PHI Publications, 3rd Edition, 2004.

3. Introduction to computers , Peter Norton's

BCA2102: Programming Concepts Using 'C'
Course Objective:
  1. To provide the basic fundamental knowledge about various concepts of programming.
  2. Clear understanding of the basic terminology required for programming.

Learning Outcome: On completion of this course students will be able to:

  1. Knows how a computer works and provides a basic knowledge about the hardware and software of a computer.
  2. Understand various constructs of the C Language along with proper syntax.
  3. Develop programs on various topics.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**MS DOS:** Introduction: Files and Directories; Commands: Internal Commands, External Commands; Batch Files; Evolution of Programming Languages; Programming Approaches: Top-down Approach, Bottom-up Approach; Algorithm; Flowchart; Source Code; Object Code; Executable File; **Introduction to C:** Data Types: Primitive Data types, Derived Data types, User-Defined Data Types; **Operators:** Different Types of Operators, Precedence of Operators, Expression and Statements, Types of Statements; **Token:** Variables, Constants, Literals, Identifiers, Keyword, Escape Sequence, Typecasting	30 Hours	1
II	**Decision Control Structures:** If Statement, If-else statement, Nested if(), If() ladder, Switch-case statement; **Iterative statements:** For loop, While loop, Do-while() loop, Conditional statements: Break, Continue; Storage Classes; **Array:** Declaration of an Array, Initialization of Array, Types of Array: Single Dimension Array, Two-Dimensional Array; Address Calculation of an Element of a 2-D Array	30 Hours	1
III	**Functions & Pointers:** Library Functions; User-Defined Functions; Function Declaration; Prototype Declaration; Types of Arguments: Actual Arguments, Formal Arguments; Function Definition; Passing Arrays as Parameters; Methods to Call a Function: Call by Value, Call by Reference; **Pointers:** Declaration of Pointer Variables; Pointer Arithmetic; Returning Multiple Output Values through a Function Strings	30 Hours	1
IV	Structures; Unions; Array of Structures; Enumerations; **File Handling:** Opening a File, Closing a File, File-Opening Modes, Reading from and Writing to a File,	30 Hours	1

	Copying Content of an Existing File to another, Command Line Arguments, argc and argv Parameters, Preprocessor Directives		

Suggested Readings:
1. E.Balagurusamy, "Programming in ANSI C", TMH
2. Peter Norton's, "Introduction to Computers", TMH
3. Kernighan, Ritchie, "The C Programming Language", PHI
4. Yashwant Kanitakar, "Let us C", BPB

BCA2103: Digital Electronics
Course Objective:
1. Provide a better understanding of Computer Organization, its designing & implementation.
2. Provide the understanding and uses of flip flops.
3. To enable student to implement synchronous state machine using flip flops.

Learning Outcome: On completion of this course students will be able to:

1. Understand the concept of logic family in order to build digital circuits and the obsolescence curve associated to a given logic family.
2. Simplify or minimize logic functions with up to 5 input variables by means of Karnaugh maps.
3. Use digital timing diagrams to specify a combinational circuits' behavior or to verify its operation.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Number System & Boolean Algebra** Number System: Binary, Octal, Decimal, Hexadecimal; Conversion of Number System; Binary Arithmetic & Complement, Binary Codes: Weighted & Non Weighted, Gray Code, Excess-3 Code. Error Detection Codes: Hamming Code; Boolean Function; Boolean Postulates; De-Morgan's Theorem; Boolean Expressions: Sum of Product, Product of Sum, Minimization of Boolean Expressions using K-Map; Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR; Implementations of Logic Functions using Gates; NAND- NOR Implementations; Multilevel gate Implementations.	30 Hours	1
II	**Combinational Circuits** Adders & Subtractors: Half Adder, Full Adder, Binary Adder, Half Subtractor, Full Subtractor, Adder Subtractor; Magnitude Comparator: Two Bit Magnitude Comparator, Three Bit Magnitude Comparator; Multiplexer & De-Multiplexer: 4*1 Multiplexer, 8*1 Multiplexer; Decoder & Encoder; Parity Checker & Generator; Code Converter.	30 Hours	1
III	**Sequential Circuit:** Introduction to Flip Flops: SR, JK, T, D, Master Slave Flip Flops; Conversion of Flip Flops; Characteristic Table & Equation; Edge Triggering & Level Triggering; Excitation Table; State Diagram; State Table; State Reduction; Design of Sequential Circuits.	30 Hours	1

IV	**Registers** Introduction of Registers; Classification of Registers; Register with Parallel Load; Shift Registers; Bidirectional Shift Register with Parallel Load. **Counters** Introduction of Counter; Asynchronous/Ripple Counters; Synchronous Counters; BCD Counter; 4-bit Binary Counter with Parallel Load; Design of Synchronous Counters; Ring Counter; Johnson Counter.	30 Hours	1

Suggested Readings:

1. V. Rajaraman, "Fundamental of Computers", PHI Publications, 3rd Edition, 2004.
2. P. K. Sinha , "Fundamental of Computers".
3. M. Mano, "Digital Logic and Computer Design", 2nd Edition, PHI.
4. R. P. Jain, "Modern Digital Electronics", Tata Mc Graw Hill, 2003.
5. P. Raja, "Switching Theory", Fourth Edition, Umesh Publication.

BCA2104: Mathematics I
Course Objective:

1. To understand the basic concepts of mathematics.
2. To get the knowledge about the matrices, determinants and limits.
3. To study the basics of differential and integral calculus.

Learning Outcome: On completion of this course students will be able to:

1. Evaluate derivatives for complexly constructed elementary functions.
2. Evaluate definite and indefinite integrals.
3. Evaluate limits using algebraic, geometric, analytic techniques.
4. Demonstrate proficiency in calculus.
5. Evaluate matrices and determinents.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Determinants:** Definition, Minors, Cofactors, Properties of Determinants. **Matrices:** Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramers Rule, Rank of Matrix Dependence of Vectors, Eigen Vectors of a Matrix, Caley-Hamilton Theorem.	30 Hours	1
II	**Differntial Calculas:** Successive Differentaition, Leibnitz's theorem, Taylor's Series, Maclaurin's series, Rolle's theorem, Mean value theorem, Maxima and Minima, Point of Inflexion; Tangent and Normals of simple curve Partial Differentiation, Definition and examples of Curvature, Asymptotes, Tracing of Curves.	30 Hours	1
III	**Integral Calculas**: Integral as Limit of Sum, Definite Integrals, Multiple Integrals, Quadrature, Rectification, Volume and Surface of Revolution.	30 Hours	1
IV	Differential Equations, Solutions with separation variable, homogenous equation, Linear equation, reducible to variable separable, reducible to homogenous and first order linear differential equation with constant coefficient.	30 Hours	1

Suggested Readings:
1. H.K. Dass, "Advanced Engineering Mathematics", S. Chand & Company, 9th Revised Edition, 2001
2. Shanti Narayan, "Integral Calculus", S. Chand & Company
3. Shanti Narayan, "Differential Calculus", S.Chand & Company

BCA2105: Professional Communication
Course Objective:

1. To improve the knowledge of students with special regards to basics of communication and its various kinds.
2. To inculcate among student comprehension of concepts, process and importance of communication.
3. To make students comprehend the art of communication, through written medium, body, time distance and orally.

Learning Outcome: On completion of this course students will be able to:

1. Understand and apply the dynamics of communication and its application.
2. Understand and relate the oral communication with kinesics, chronemics, proxemics etc.
3. Able to read, write, articulate with precision.
4. Able to understand and apply the intricacies of art of communication.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Fundamentals of Communication: Definition, Nature, Origin, Scope, Features, Process; Types of Communication; The Flow of Communication: Upward, Downward, Lateral, Horizontal; Technical Communication: Definition; Oral & Written Communication; Distinction between Technical & General Communication; Importance of Technical Communication for Technocrats & Professionals; Barriers to Communication: Types of Barriers; Measures to Overcome Barriers	30 Hours	1
II	Formal Communication: Verbal: Group Discussion, Interview, Extempore, Public Speaking, Counselling, Business Negotiation; Written Comprehension ; Developing Writing Skills: Note taking, Reviewing, Interpreting, Paraphrasing; Requisites of Good Sentences: Essentials of Good Sentences, Common Errors to be avoided; Requisites of Good Paragraph Writing: Unity, Coherence, Clarity, Proper Length, Emphasis; Development of Paragraphs; Methods: Inductive, Deductive, Chronological, Spatial, Comparison & Contrast	30 Hours	1
III	**Business Correspondence** Principles: 7 C's of Communication; Formats of Business Letters; Sales & Credit Letters; Inquiry, Quotation & Reply Letters; **Job Letters** Cover letters; Resume: Chronological, Functional	30 Hours	1

	Presentation Strategies		
IV	Speech, Purpose, Understanding Audience & Locale Organizing the Material, Audio-Visual Aids; Methods of Speaking: Manuscript, Impromptu, Memorization, Extempore; Non-Verbal Dimensions of Communication: Paralanguage, Kinesics, Proxemics, Haptics, Chronemics, Oculecsis	30 Hours	1

Suggested Readings:

4. Minakshi Raman et al. Technical Communication, New Delhi: Oxford University Press, 2014.
5. Singh, R.P. Functional Skills in Language & Literature, New Delhi: Rupa, 2007.
6. Sharma, Sangeeta et al. Communication Skills for Engineers and Scientists, New Delhi: PHI, New Delhi, 2009.
7. Shukla, Aditya. Professional Communication, Pune: Technical Publications, 2013.

BCA2151: 'C' Programming Lab

Module	Course Topics	Credits
I	1. Implementation of Fundamental Data Types. 2. Implementation of Fundamental Operators. 3. Implementation of Conditional Program such as if, switch etc. 4. Implementation of Basic Control Constructs such as for loop, while loop, do while loop. 5. Implementation of Functions.	1
II	1. Implementation of Advance Control Constructs such as Arrays & structures etc. 2. Implementation of Pointers. 3. Implementation of Pointers as Function Arguments. 4. Implementation of File. 5. Implementation of Command Line arguments.	1

BCA2152: Digital Electronics Lab

Module	Course Topics	Credits
I	1. Implementation of Gates. 2. State & Prove De Morgan's Law. 3. Verification of Expressions using Gates. 4. Verification of various gates (NOT, OR, AND, Ex-OR, Ex-NOR) using universal gates. (NAND & NOR). 5. Implementation of Adders & Subtractors. 6. Implementation of Code Converters. 7. Implementation of Parity Checker & Generators. 8. Implementation of Parity Magnitude Comparator. 9. Design and Implementation of Combinational Circuits.	1
II	1. Proving of Characteristic table of different Flip Flops. 2. Prove the Conversion Logic of various Flip Flops. 3. Design & Prove the State Table and State Diagram of various flip flop input functions. 4. Design of sequential Circuit using different Flip Flops. 5. Design of various counters using various Flip Flops. 6. Design the sequential circuit using a 2-bit register and combinational gates. 7. Design and Implementation of BCD Counters. 8. Design and Implementation of Ripple Counter. 9. Construct the Johnson Counter.	1

BCA2201: Data Structure Using 'C'
Course Objective:

1. The objective of this course is to make the student learn fundamental data structures algorithms.
2. The course describes and implements algorithms such as stacks, queues, linked lists, trees, searching techniques, sorting techniques, hashing techniques and graphs.
3. Comprehend alternative implementations using the differing logical relationships and appreciate the significance of choosing a particular logical relationship for implementation within real-world setting.
4. Demonstrate the ability to plan, design, execute and document sophisticated technical programs to handle various sorts of data structures.
5. Be familiar with the use of data structures as the foundational base for computer solutions to problems.
6. Become introduced to and investigate the differing logical relationships among various data items.

Learning Outcome: Having successfully completed this course, the student will be able to:

1. Apply advance C programming techniques such as pointers, dynamic memory allocation, structures to developing solutions for particular problems.
2. Design and implement abstract data types such as linked list, stack, queue and tree by using C as the programming language using static or dynamic implementations.
3. Analyse, evaluate and choose appropriate abstract data types and algorithms to solve particular problems.
4. Design and implement C programs that apply abstract data types.
   .

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Introduction to Data Structures.Classification of Data Structure, Operations on Data Structure, Dynamic Memory Allocation, Types of Case Analysis Arrays: Address Calculation, , Application of arrays, Limitation of Array, Application of Arrays, Array as Parameters, Sparse Matrices	30 Hours	1
II	Continuous Implementation (Stack): Array Representation, Operations on Stacks: Push & Pop, Applications of stack, Conversion of Infix to Prefix and Postfix Expressions , Evaluation of postfix expression using stack Recurssion : Recursive Definition and Processes, Principles ofn Recursion, Tower of Hanoi Problem, Recursion Vs. Iteration Continuous	30 Hours	

	Implementation(Queue): Array representation and implementation of Queues, Operations on Queue: Create, Add, Delete, Full and Empty Queue , Circular Queue, Dequeue and Priority Queue		
III	**Non Continuous Implementation:** Link Lists: Linear List concept, List v/s Array, Linked List Terminology, Representation of Linked List in Memory, Types of Linked List, Single Linked List, Doubly Linked List, Single Circular Linked list, Circular Doubly Linked List, Operations on Link List: Create List Insert node (empty list, beginning, middle, end), Delete node(first, general case), Traversing node, Searching node, Print list, Count Nodes, Sort Lists	30 Hours	1
IV	**Trees**: Introduction to Tree & its Terminology, Binary trees, Types of Binary trees, Representation of Binary Tree, Traversals (Inorder, Preorder, Postorder) , Tree Expression, Binary Search Tree, Insertion and Deletion in BST Graph Terminology Sorting & Searching Techniques: Bubble Sort , Selection Sort, Insertion Sort, Shell Sort, Quick Sort , Merge Sort, Sequential Search, Binary Search	30 Hours	1

Suggested Readings:
1. Y. Langsam, M. Augenstin and A. Tannenbaum, "Data Structures using C and C++", Pearson Education Asia, 2nd Edition, 2002.
2. Ellis Horowitz, S. Sahni, D. Mehta, "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi.
3. S. Lipschutz, "Data structures", Mc-Graw-Hill International Editions, 1986.
4. Jean-Paul Tremblay, Paul. G. Soresan, "An Introduction to Data Structures with Applications", Tata Mc-Graw-Hill International Editions, 2nd edition 1984.
5. A. Michael Berman, "Data Structures via C++", Oxford University Press, 2002.
6. M. Weiss, "Data Structures and Algorithm Analysis in C++", Pearson Education, 2nd Edition, 2002.

BCA2202: Operating System
Course Objective:

1. To provide a good understanding of the underlying concepts of operating systems.
2. To provide an opportunity to apply the concepts learned through implementation of the components of operating systems.

Learning Outcome: Upon successful completion of the course the student will:

1. Understand the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
2. Understand the main mechanisms used for inter-process communication.
3. Be able to give the rationale for virtual memory abstractions in operating systems.
4. Have the ability to evaluate security risks in operating systems and understand the role operating systems can and should play in establishing security.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction and Process Management:** Work and function of Operating System; Types of Operating System; System Structure: Operating System Services, System Calls and its types, System Programs; Operating System Structure: Simple Structure, Layered Approach, Microkernel; Introduction to Process: Process States, Process Control Block; Process Scheduling: Scheduling Queues, Schedulers, Context Switch; Threads; Process Scheduling: Scheduling Objectives, Scheduling Criteria, Scheduling Policies, Scheduling Algorithms: First Come First Serve Scheduling, Shortest Job First Scheduling, Round Robin Scheduling, Priority Scheduling, Multiple-Processor Scheduling, Real-Time Scheduling, Multilevel Feedback Queue Scheduling.	30 Hours	1
II	**Process Synchronization and Deadlocks**: Critical-Section Problem; Peterson's Solution ; Semaphores: Usages of Semaphores; Classical Problems of Synchronization: Producer Consumer Problem, Dining Philosophers; Deadlock System Model; Deadlock Characterization: Necessary Condition, Resource-Allocation graph; Deadlock Handling Methods; Deadlock Prevention: Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait; Deadlock Avoidance Mechanisms: Resource Allocation graph Algorithm, Banker's Algorithm; Recovery from Deadlock: Process Termination, Resource Preemption.	30 Hours	1
III	**Memory Management**: Memory Management Strategies: Address Binding, Logical and Physical Address Space, Dynamic Linking; Swapping; Contiguous	30 Hours	1

	and Non-Contiguous Memory Allocation; Paging; Segmentation; Virtual Memory Management Concept; Demand Paging; Page Replacement Policies: Basic Page Replacement, FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement, Optimal Page Replacement, Counting Based Page Replacement; Allocation of Frames: Minimum Numbers of Frame, Allocation Algorithm, Global Versus Local Allocation; Thrashing: Cause of Thrashing, Locality of Reference.		
IV	**Storage Management:** File Concept: File Attribute, File Operations, File Types**,** File Structure; File Access Method: Sequential Method, Direct Access Method; Directory Structure; File System Implementation: File System Structure, Allocation Methods**,** Free space Management; Secondary Storage Structure: Disk Structure**,** Disk Scheduling Algorithms**,** Disk Management	30 Hours	1

Suggested Readings:

1. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", Addison-Wesley.

2. Andrew S. Tanenbaum, "Modern Operating Systems", Prentice Hall.
3. Milan Milankovic, "Operating Systems, Concepts and Design", TMH.
4. William Stallings, "Operating Systems: Internal and Design Principles", PHI.

BCA2203: System Analysis & Design
Course Objective:

1. To presents a comprehensive introduction to the system analysis and design skill in information management.
2. To provide the students with the skills to identify business problems which may be solved by technology based solutions and develop design which form the basis for implementing systems as well as a strong foundation in systems analysis and design concepts, methodologies, techniques and tools.
3. This also include waterfall model (system development life cycle), system analysis and Design Technique (Process Modeling (DFDs), Logical Modeling (decision tree, decision table, structured English).

Learning Outcomes On completion of this course students will be able to:

1. Describe the different phases of systems development life cycle.
2. Describe the different fact-finding techniques in system analysis and design.
3. Explain different methodologies of analysis and design of information systems.
4. Describe the concepts and theories of systems approach.
5. Design appropriate information systems.
6. Manage the development of systems based on system specifications.
7. Manage implementation and maintenance of information systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of Systems Concepts, Analysis and Design Life cycle** Introduction to System Concept: Characteristics of the system, Elements of a System, Types of Systems, Physical and Abstract System, Open and Closed System, Formal and Informal System; Introduction to Data and Information: Types of Information System, Categories of Information System, Needs of Information Systems, Qualities of Information System; Software Development Life Cycle (SDLC); Role and Attributes of System Analyst.	30 Hours	1
II	**System Planning and Requirements Determination** System planning and initial investigation: Strategic Plan for Information processing, Tools for Planning, Problems in Planning, Need for requirement definition; Information gathering tools: Review of Literature, procedures and forms, On-Site observation, Interviews and Questionnaires; Methodologies, Tools and Techniques of Analysis Systems Analysis and Design: Decision Tree , Data Dictionary, Decision Table , Structured English, Data Flow Diagram, Components of a DFD, Zero Level DFD,DFD Transformation and Decomposition, Context Diagram, Leveling a DFD; Feasibility Study: Economic	30 Hours	1

	Feasibility(Cost & Benefit Analysis), Organizational Feasibility, Technical Feasibility , Behavioral Feasibility study.		
III	**System Design and Implementation** Process of Design: Logical and Physical Design, Design Methodologies, Elements of Form Design, Design of Output, Design of Input , Design of File, Design of procedure; Audit Trail; System Implementation and Testing: Operational and Test Environment, Conversion Preparation, Database installation, Users Training and Final Report to Management, Creating a new System; Test Plan: Activity Network for system Testing, Types of Testing.	30 Hours	1
IV	**System Quality Assurance, IT infrastructure Selection and Evaluation of Processing and Maintenance** Quality Assurance: Quality factors specifications, Levels of Quality Assurance**;** Computer Hardware and Software Selection: Computer Configuration Determination**,** Requesting Proposal from Vendors, Evaluation of Vendor's Proposals**,** Acceptance of system; Evaluation of Processing**,** Need of Maintenance.	30 Hours	1

Suggested Readings:

1. Elias Awad   Systems Analysis And Design, Galgotia Publications.
2. V. Rajaraman   Analysis & Design of Information System, PHI.
3. Hussain & Hussain   Information Systems Analysis, Design and Implementation, McGraw Hill

BCA2204: Mathematics II
Course Objective:

1. Subject introduces some of the basic concepts of Discrete Mathematics.
2. Students should be able to prove mathematical statements by means of inductive reasoning.
3. Students should be able to demonstrate an understanding of the principle of recursion and apply it to the study of sequences and sets.

Learning Outcomes: On completion of this course students will be able to:

1. Understand the basic concepts of set theory.
2. Demonstrate the ability to solve problems using Relation and Function.
3. Solve problems involving Poset and Lattices.
4. Use Group and Ring as tools to visualize and simplify situations.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Set Theory** Definition of Sets, Set Representation, Type of Sets, Cardinality of Set, Venn Diagrams, Operation on Sets, Disjoint Sets, Subsets, Power Set, Cartesian Product, Properties of Sets, Proving Set Identities, Duality, Countable and Uncountable Sets, Principle of Inclusion and Exclusion, Multisets	30 Hours	1
II	**Relation & Function** Relation:Binary Relations, Properties of Binary Relations, Representation of Relations, Inverse Relation, Composition of Relations, Properties of Relations, Relations, Equivalence Relations, Partitions,. Function: Definition, Type of Functions, One-to-One Function, Onto Function, Technique to Prove a Function as Onto, One-to-One Correspondence, Inverse Function, Compositions of Functions, Recursively defined Functions.	30 Hours	1
III	**Posets, Hasse Diagram and Lattices:** Introduction, Ordered Set, Partial order relations, Well Ordered Set, Hasse Diagram of Poset, Minimal and Maximal element in a poset, Least and Greatest element, Upper and Least Bounds; Lattices: Properties of Lattices, Types of Lattices.	30 Hours	1
IV	**Groups and Rings:** Binary Operation, Type of Binary Operations, Algebraic Systems, Prosperities, Types i.e. Semi group, Monoid, Groups, Abelian Group, Properties of Groups, Subgroups, Permutation Group, Factor Group, Cyclic Groups, Cosets, Normal Subgroup, Homomorphism and Isomorphism of	30 Hours	1

	Groups, Ring: Types of Rings, Integral Domain; Field.		

Suggested Readings:

1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", TMH, New Delhi, 2000.
2. Kolman, Busby and Ross "Discrete Mathematical Structures" PHI/Pearson., 6th Ed., 2009.
3. Kenneth H. Rosen, "Discrete Mathematics & Applications", TMH, 6th Ed., 2007.
4. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill Book Company, 2nd Ed., 1985.
5. Narsingh Deo, "Graph Theory", PHI, 24th Indian Print, 2003.

BCA2205: Computer Organization and Architecture
Course Objective:

1. To provide a good understanding of the underlying concepts of Computer organization.
2. Explain Computer performance measurement methods.
3. Student should learn how to quantitatively evaluate different designs and organizations.
4. Student should be able to articulate design issues in the development of processor or other components that satisfy design requirements.

Learning Outcome: Upon successful completion of the course the student will:

1. Describe software and hardware interaction layers in computer architecture.
2. Describe various machine language instructions.
3. Be familiar with the terminology and basic principles of Computer organization systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Register Transfer and Micro-operation** Register Transfer Language: Register Transfer, Bus and Memory Transfer; Micro operations: Arithmetic, Logical, Shift Micro-operations; Arithmetic logic shift unit; Timing and control; Instruction codes; Computer instructions; Machine language instructions. **Basic Computer Organizations and Design** Instruction Cycle; Memory Reference Instructions; Register Reference Instructions; Input-Output Instructions; Design of Accumulator Logic Shift Unit; Instructions Format.	30 Hours	1
II	**Central Processing Unit** Accumulator based organization; General register organization; Stack organization; Addressing modes; RISC vs. CISC; Hard wired & micro programmed control Unit. **I/O Organizations** Introduction to system buses; Input/ output interface; Interrupt and Interrupt handling: S/W Interrupt, Daisy Chaining, Priority Interrupt; Device Polling; Serial Vs Parallel communications; Synchronous Data Transfer; Synchronous Data Transfer methods: Strobe Control, handshaking; Modes of Data Transfer: Programmed I/O, Interrupt initiated I/O; DMA: DMA Controller, DMA Transfer.	30 Hours	1
III	**Memory organization**	30 Hours	1

	Memory hierarchy, Main Memory: RAM Chips, ROM Chips; Concept of address space & Memory Space; Address Mapping; Auxiliary Memory; Cache memory: Mapping Techniques: Direct mapping, Associative mapping, Set associative mapping; Associative memory.		
IV	**Concept of Parallel Processing & Microprocessor** Uniprocessor System; Multiprocessor System; Pipelining Vs Parallelism; Flynn's and Fang's Classification; 8085 Architecture: Pin diagram, Register Sets, Instruction sets, Flags, Interrupt; Termination of Program; Instructions Vs Arithmetic Pipelining; Assembly Language Programming of 8085.	30 Hours	1

Suggested Readings:

1. M. Morris Mano, "Digital Logic & Computer Design", PHI
2. R. P. Jain, "Modern Digital Electronics", TMH
3. M. Morris Mano, "Computer System Architecture", PHI
4. B. Ram, "Computer Fundamental Architecture & Organization", NewAge
5. William Stalling, "Computer Organization & Architecture", Pearson Education Asia
6. V. Carl Hamacher, "Computer Organization", TMH
7. B. Ram, "Fundamentals of Microprocessor & Microcomputers", NewAge

BCA2251: Data Structure Using 'C' Lab

Module	Course Topics	Credits
I	1. Implementation of Arrays (Single & Double Dimension). 2. Implementation of String. 3. Implementation of Recursive Procedures. 4. Array implementation of Stack. 5. Array implementation of Queue. 6. Array implementation of Circular Queue. 7. Array implementation of Linked List. 8. Implementation of Stack using dynamic memory allocation. 9. Implementation of Queue using dynamic memory allocation. 10. Implementation of Circular Queue using dynamic memory allocation. 11. Implementation of Linked List using dynamic memory allocation.	1
II	1. Implementation of Binary tree. 2. Implementation of Linear Search. 3. Implementation of Binary Search. 4. Implementation of Bubble sort. 5. Implementation of Merge sort. 6. Implementation of Insertion sort 7. Implementation of Selection sort. 8. Implementation of Quick sort.	1

BCA2252: Computer Organization Lab

Module	Course Topics	Credits
I	1. Study Architecture of 8085and familiarization with its Software mnemonics of Microprocessor 8085. 2. Write a program using 8085 & verify for : A. Addition of two 8-bit numbers. B. Addition of two 16-bit numbers(with carry). 3. Write a program using 8085 & verify for : A. Subtraction of two 8-bit numbers. (display of barrow) B. Subtraction of two 16-bit numbers. (display of barrow) 4. Write a program using 8086 for arranging an array of numbers in descending order & verify. 5. Write a program using 8085 for finding First and second 6. compliment of an 8-bit number. 7. Write a program using 8085 for finding first and second compliment of an 16-bit number. 8. Write a program using 8085 for left shift 8-bit number by 2. 9. Write a program using 8085 for left shift 16-bit number by 2.	1
II	1. Write a Program using 8085 for masking 8-bit number. 2. Write a program using 8085 for. Largest and Smallest number in an array. 3. Write a program using 8085 to find table of any number. 4. Write a program using 8085 to Sum of elements in an array. 5. Write a program using 8085 for Sorting in Ascending and Descending Order of 8-bit number.	1

BCA2301: Design & Analysis of Algorithm
Course Objective:

1. To know the importance of studying the complexity of a given algorithm.

2. To study various algorithmic design techniques.
3. To utilize data structures and/or algorithmic design techniques in solving new problems.
4. To know and understand basic computability concepts and the complexity classes P, NP, and NP-Complete.
5. To study some techniques for solving hard problems.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
2. Apply the algorithms and design techniques to solve problems.
3. Analyze the complexities of various problems in different domains.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Basic Concepts of Algorithms** Definition of algorithm; Characteristic of algorithm; Pseudo Codes & Time Complexity of Basic Control Structures; Time and Space Complexity of Insertion Sort; Selection Sort; Heap Sort ; Bubble Sort; Asymptotic Notations (Growth of Functions).	30 Hours	1
II	**Divide and conquer:** Binary Search, Maximum & Minimum, Merge Sort, Quick Sort, Strassen's matrix multiplication; **Greedy Method:** General method, Knapsack Problem, Travelling Salesman problem, Job Sequencing with deadline, Optimal Storage on tapes, Huffman Codes, An Activity Selection Problem	30 Hours	1
III	**Dynamic Programming:** Assembly Line Scheduling, Matrix Chain Multiplications, Longest Common Subsequence; **Backtracking:** General method, N Queens Problem, Sum of subsets, Hamiltonian Circuit Problem	30 Hours	1
IV	**Branch & Bound:** Introduction, Live Node, Dead Node and Bounding Functions, Travelling Salesman Problem, Knapsack Problem, Assgnment Problem; **Analysis of Graph Algorithms:** Elementary Graph Algorithms, Multistage Graphs, Minimum Spanning Trees: Kruskal's & Prim's Algorithm, Single Source Shortest Path: Dijkstra's & Bellman Ford, All Pairs Shortest Path: Warshal Algorithm, Maximum Flow: Ford Fulkerson Algorithm	30 Hours	1

Suggested Readings:

1. Thomas H. Coremen, "Introduction to Algorithms", PHI.
2. Horowitz & Sahani, "Fundamental of Algorithms", Galgotia.
3. Aho, "Design & Analysis of Computer Algorithms", Pearson.
4. Johnsonbaugh, "Algorithms", Pearson.
5. Bressard "Fundamental of Algorithm", PHI.
6. Jon Kleinberg and Eva Tardos "Algorithm Design", Pearson Education, 2006.

BCA2302: Data Base Management System
Course Objective:

1. To present the fundamental concepts of Database Management.
2. To develop skill of Database Design, Database Languages and Database-System implementation with respect to Relational Database Management System.
3. To develop the concepts of Transaction Processing System , Concurrency control and Recovery procedures in database.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the basic concepts of the database and data models.
2. Design a database using ER diagrams and map ER into Relations and normalize the relations.
3. Develop a simple database applications using normalization.
4. Acquire the knowledge about different special purpose databases and to critique how they differ from traditional database systems.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Database System Concepts, Database Users, and Architecture** Introduction to Database System with example, Introduction to Traditional File Oriented System, Characteristics of the Database Approach , Components of Database System, Database Users, Advantages and disadvantages of Using a DBMS, Structure of DBMS, Database Schemas and Instances , DBMS Architecture (ANSI/SPARC), Data Independence, Database Languages and Interfaces, Classification of Database Management Systems.	30 Hours	1
II	**Data Modeling & Relational Database Management System** Data Modeling Using the Entity-Relationship Model: Entity Types, Entity Sets, Attributes, and Keys, Relationships, Relationship Types, Roles, and Structural, Constraints , Weak Entity Types , ER Diagrams, Naming Conventions, and Design Issues. The Relational Data Model, Relational Constraints, and the Relational Algebra: Relational Model Concepts , Codd's Rules for relational algebra, Relational Constraints and Relational Database Schemas Update Operations and Dealing with Constraint Violations, Basic Relational Algebra Operations, Additional Relational Operations, Examples of Queries in	30 Hours	1

	Relational Algebra.		
III	**SQL and Database Design Theory and Methodology** **Structured Query Language- The Relational Database Standard:** Data Definition, Constraints, and Schema Changes in SQL, Types of SQL Commands, SQL Operators and their Procedure, Insert, Delete, and Update Statements in SQL, Queries and Sub Queries, Aggregate Functions, Joins, Unions, Intersection, Minus, Views (Virtual Tables) in SQL. **Functional Dependencies and Normalization for Relational Databases:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Armstrong Rules, Closure of Attributes, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form.	30 Hours	1
IV	**Transaction Processing, Concurrency Control and Distributed Database** Transaction Processing Concepts: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties of Transactions, Concurrency Control Techniques, Locking Techniques for Concurrency Control, Concurrency Control Based on Timestamp Ordering.	30 Hours	1

Suggested Readings:

1. Date C. J.   An Introduction to Data Base System, Addision Wesley.
2. Korth, Silbertz, Sudarshan   Data Base Concepts, McGraw-Hill.
3. Elmasri, Navathe   Fundamentals Of Data Base Systems, Addision Wesley.
4. Bipin C. Desai   An introduction to Data Base Systems, Galgotia Publication.
5. Ramakrishnan, Gehrke   Data Base Management System, McGraw-Hill.
6. Connolly & Begg   Database Systems: A Practical Approach to Design, Implementation and Management, Pearson Education.
7. R. S. Despandey --SQL/PL SQL for Oracle.
8. Ivan Bayross -- SQL, PL/SQL: The Programming Language Of Oracle

BCA2303: Object Oriented Programming Using C++
Course Objective

1. To present the fundamental concepts of Object Oriented Programming.
2. To develop skill of Programming with respect to C++.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Understand the C++ constructs.
2. Students will be able to write programs in C++.
3. Shift from structural programming to Object Oriented Programming.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to Object Oriented Programming:** Introduction Procedural Vs Object Oriented Programming; Classes and Object; OOPS Features: Data Abstraction, Inheritance, Encapsulation, Polymorphism, Dynamic Binding, Message Passing; A Brief History of C & C++; A Simple C++ Program; Application of C++; Structure & Class, Compiling & Linking; Tokens, Keywords, Identifiers & Constants; Basic Data Types; User-Defined Data Types; Symbolic Constant; Type Compatibility; Reference Variables; Operator in C++: Scope Resolution Operator, Member Dereferencing Operators, Memory Management Operators, Manipulators, Type Cast Operator	30 Hours	1
II	**Functions In C++:** The Main Function; Function Prototyping; Function Call: Call by Reference, Call by Address, Call by Value; Return by Reference; Inline Function; Default Arguments; Const Arguments; Function Overloading; Friend Function; Function with Array; **Classes & Object:** A Sample C++ Program with class; Defining Member Functions; Making an Outside Function Inline; Nesting of Member Functions; Private Member Functions; Arrays within a Class; Memory Allocation for Objects; Static Data Members; Static Member Functions; Arrays of Objects; Object as Function Arguments; Friendly Functions; Returning Objects; Const member functions; Pointer to Members; Local Classes	30 Hours	1
III	**Constructor & Destructor:** Parameterized Constructor; Multiple Constructor in a Class; Constructors with Default Arguments; Dynamic Initialization of Objects; Copy Constructor; Dynamic Constructor; Const Object; Destructor; **Inheritance:** Defining Derived Classes, Single	30 Hours	1

	Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Hierarchical Inheritance, Multiple Inheritance, Hybrid Inheritance; Virtual Base Classes; Abstract Classes; Constructor in Derived Classes; Nesting of Classes		
IV	**Operator Overloading & Generic Programming & Exception Handling:** Operator Overloading; Type Conversion; Polymorphism; Pointers; Pointers with Arrays C++; Streams: C++ Stream Classes, Unformatted I/O Operation, Formatted I/O Operation, Managing Output with Manipulators; **Template:** Template Classes; Explicit Class; **Exception handling:** Exception Handling Fundamentals; The try Block, The catch Exception Handler, The throw Statements	30 Hours	1

Suggested Readings:

1. Herbert Schildt,"C++ The Complete Reference",TMH
2. Ashok N. Kamthane, "Programming in C++", Pearson
3. E. Balagurusamy, "Object Oriented Programming with C++" TMH
4. Stanley Lippman & Lajoi, "C++ Primer"
5. Bjarne Stroustrup, "C++ Programming Language"

BCA2304: Computer Communication & Computer Networks
Course Objective:

1. To introduce basic elements of communication system.
2. Techniques, channels and devices used to transmit data between distant locations.
3. To introduce the functions of different layers.
4. Understand different protocols and network components.

Learning Outcome: Upon successful completion of the course the student will be able to:

1. Describe and analyze the hardware, software, components of a network.
2. Explain networking protocols and their hierarchical relationship hardware and software. Compare protocol models and select appropriate protocols for a particular design.
3. Explain concepts and theories of networking and apply them to various situations, classifying networks, analyzing performance and implementing new technologies.
4. Identify infrastructure components and the roles they serve, and design infrastructure including devices, topologies, protocols, systems software, management and security.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Data Transmission :** Analog and Digital - Data, Signals, Transmission Systems, Asynchronous and Synchronous transmission; Analog and Digital Transmission; Bandwidth, Channel Capacity- Nyquist Bandwidth, Shannon Capacity Formula, Baud v/s Bit Rate, Transmission Impairments, Modulation **Data Transmission & Transmission Media:** Multiplexing-FDM, TDM, WDM, Concepts of Frequency Spread Spectrum, Transmission Media (Guided, Unguided), Switching- Message, Circuit, Packet, Frame relay and Cell relay, Asynchronous Transfer Mode(ATM).	30 Hours	1
II	**Introduction to Computer Network** Types of Network: Based on Topology (Bus, Star, Ring Mesh, Tree); Based on Size Technology and ownership (LAN, MAN, WAN); Based on Computing (Centralized, Distributed and Collaborative), Based on Connection management ; Design Issues for the Layers; Interfaces and Services; ISO-OSI Reference Model and TCP/IP Model; **Physical Layer:** Design Issues, Services provided to Upper Layer, Physical Layer Specification (Mechanical, Electrical, Functional and Procedural)	30 Hours	1
III	**Data Link Layer:** Services provided to the Upper Layer, Framing, Error Control, Flow Control; IEEE Standards for MAC Sublayer; **Network Layer**: Services provided to the Upper Layer: Routing Algorithms (Centralized, Distributed	30 Hours	1

	and Isolated), Congestion Control(Token Based and Non Token Based), Internetworking (Negotiations across Subnet)		
IV	**Upper Layers:** Transport Layer: Services provided to the Upper Layers, Elements of Transport Control Protocols- Physical Connection Management, Flow Control, Multiplexing, Host-To-Host Acknowledgement, Crash Recovery; Introduction to TCP and UDP; Introduction of Session Layer; Presentation Layer; Application Layers and their functions	30 Hours	1

Suggested Readings:

1. W. Stallings, "Data and Computer Communication", Pearson Education.
2. A. S. Tanenbaum, "Computer Network", 4th, Edition, Pearson Education.
3. Forouzan, "Data Communication and Networking", 2nd Edition, Tata McGraw Hill.
4. W. Stallings," Computer Network with Internet Protocols", Pearson Education.
5. Eugene Blanchard "Introduction to Networking and Data Communications".
6. J. Martin "Computer Network and Distributed Data Processing", PHI.

BCA2305: Discrete Mathematics
Course Objective:

4. Students should be able to distinguish between the notion of discrete and continuous mathematical structures.
5. Students should be able to understand the basic concepts of set theory.
6. Students should be able to apply fundamental counting algorithms to solve applied problems in the area of computer science.
7. Students should be able to prove mathematical statements by means of inductive reasoning.
8. Students should be able to understand the principle of recursion and apply it to the study of sequences and sets.

Learning Outcomes: On completion of this course students will be able to:

5. Verify the correctness of an argument using propositional and predicate logic and truth tables.
6. Demonstrate the ability to solve problems using counting techniques and combinatorics.
7. Solve problems of recurrence relations and generating functions.
8. Use graphs and trees as tools to visualize and simplify network related problems.
9. Perform operations on discrete structures such as sets, functions, relations, and sequences.
10. Construct proofs using direct proof, proof by contraposition, proof by contradiction, proof by cases and mathematical induction.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Discrete Numeric Function and Recurrence Relation:** Numeric Function; Generating Function; Recurrence Relation: Linear Recurrence Relation with Constant Coefficients, Homogeneous and Particular Solution, Total Solution, Solution by Method of Generating Function	30 Hours	1
II	**Counting Techniques & Probability**: Basics of Counting; Sum and Product rules; Pigeonholes Principle; Combinations and Permutations: Generalized Permutations and Combinations; **Probability:** Some Basic Concepts, Types of Events, Probability of an Event, Conditional Probability.	30 Hours	1
III	**Fundamentals of Logics:** Introduction, Proposition, First order Logic, Logical Operation, Truth Values, Compound Proposition, Tautologies, Contradiction, Logical Equivalences, De-Morgan's laws, Duality, Predicates, Universal and Existential Quantifiers.	30 Hours	1
IV	**Graph:** Simple Graph, Multi Graph, Graph Terminology, Bipartite, Regular and Planar Graph, Directed Graph,	30 Hours	1

| | Euler Graphs, Hamiltonian Path and Circuits, Graph Coloring, Chromatic Number, Weighted Graphs, Shortest Path in Weighted Graphs.
Tree: Trivial and Non-Trivial Tree, Rooted Tree, Distance and Centers in a Tree, Path Length in Rooted Tree, Spanning Tree, Minimal Spanning Tree, Kruskal's and Prim's Algorithms. | | |

Suggested Readings:
1. J. P. Tremblay and R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", TMH, New Delhi, 2000.
2. Kolman, Busby and Ross "Discrete Mathematical Structures" PHI/Pearson., 6th Ed., 2009.
3. Kenneth H. Rosen, "Discrete Mathematics & Applications", TMH, 6th Ed., 2007.
4. C. L. Liu, "Elements of Discrete Mathematics", McGraw Hill Book Company, 2nd Ed., 1985.
5. Narsingh Deo, "Graph Theory", PHI, 24th Indian Print, 2003.

BCA2351: Data Base Management System Lab

Module	Course Topics	Credits
I	1. Use of DDL for creating objects(Table, Database). 2. Use of DML for performing retrieval operations. 3. Use of DCL for specifying constraints on tables. 4. Use of commands for Schema Changes in SQL. 5. Use of Aggregate Functions. 6. Use of Different Operators in SQL. 7. Use of String Functions.	1
II	1. Grouping of Records. 2. Ordering of Records. 3. Creating Views. 4. Performing Subqueries. 5. Performing queries for Union & intersection, difference and Cartesian product. 6. Performing queries for various Joins.	1

BCA2352: Object Oriented Programming Using C++ Lab

Module	Course Topics	Credits
I	1. Implementation of Fundamental Data Types & Testing and Debugging of Programs. 2. Implementation of Basic Control Constructs such as loops etc. 3. Implementation of operators in C++. 4. Implementation of Functions. 5. Implementation of Inline Function. 6. Implementation of Default Arguments. 7. Implementation of Const Arguments. 8. Implementation of Function Overloading. 9. Implementation of Friend Function. 10. Implementation of classes & objects. 11. Implementation of Arrays within a Class.	1
II	1. Implementation of Static Data Members. 2. Implementation of Static Member Functions. 3. Arrays of Objects. 4. Implementation of constructors. 5. Implementation of Inheritance. 6. Implementation of Operator Overloading. 7. Implementation of Template class. 8. Implementaion of Exception Handling.	1

BCA2401: UNIX & Shell Programming
Course Objective:

1. To present the fundamental concepts of UNIX.
2. To get an understanding of Multiuser, Multitasking and Timesharing System.
3. To introduce the significance of Open Source Software.
4. Introduction of GUI of UNIX (i.e.LINUX).

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of UNIX.
2. Develop the skills in Shell Programming.
3. Understand the Process and its synchronization.
4. Will get the understanding of System Administration in UNIX.
5. Get the understanding of PIPES, Filters, Redirection and Semaphore, Message Queues and other process synchronization aids.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction to UNIX** Features of Unix, Unix system organization (the kernel and the shell), Files and directories, Hierarchical File Structure, Basic Unix Commands: PATH, man, echo, passwd, uname, who, date, stty, pwd, cd,mkdir, rmdir, ls, cp, mv, rm, cat, more, wc.; Unix Utilities, Introduction to Unix file system: Boot block, super block, Inode table, data blocks; Library Functions and system calls	30 Hours	1
II	**Input Output Redirection & Unix Utilities:** Input Output Redirection, File handling utilities; Security by file permissions: chmod, umask, sticky bit; disk utilities-du, df; find & ulimit; Process utilities; Filters: Filters and Pipes, Concatenating files, Display Beginning and End of files, Cut and Paste, Sorting, Translating Characters, Files with Duplicate Lines, Count characters, Words or Lines, Comparing Files, grep	30 Hours	1
III	**vi editor** Types of editors, Basic features, modes of execution in vi editor, commands for Creating,& saving a file and quitting from vi, Cursor movement, Text insertion, changing and replacing text, deleting text, searching the text, Pattern Matching of text, various options to :set command, Writing, Compiling and Running a C program on Unix/Linux	30 Hours	1
IV	**Shell Programming** Types of shells, Shell Meta characters, Shell keywords	30 Hours	1

	,Shell variables, Scripting Basics , Creating Shell scripts, Shell commands, the environment, Environmental Variables, Integer arithmetic and string manipulation, Special command line characters; Decision making and loop control; File Tests, String Tests, continue and break; Using positional parameters, changing Positional Parameters, Generating Output, Handling Input, Exit Status of a Command, eval Command; Argument Validation, Debugging Scripts, Script Examples, Arrays; String Functions, Mathematical Functions, User – Defined Functions, Applications		

Suggested Readings:

1. Sumitabha Das   Unix Concepts and Applications, TMH.
2. Yashwant Kanetkar   Unix Shell Progamming, BPB.
3. Meeta Gandhi,   The C Odyssey Unix–the open boundless C, BPB.

BCA2402: Numerical & Statistical Techniques
Course Objective:

1. To implement computational problems on machine.
2. To offer sound knowledge on statistical tools.
3. To compute the relevant statistical measures for different types of data.
4. To analyze the statistical data based on experiments.

Learning Outcome: Upon successful completion of the course the student will be able to:
1. To apply statistical distributions for real life problems.
2. To draw valid inferences based on the analysis of statistical data.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Errors and Floating Point Numbers** Errors in numerical computation: Sources of Errors, Types of Errors; Representation of Floating point numbers: Arithmetic operations on Floating Point numbers, Normalization of Floating Point numbers, Pitfalls of Floating Point representation. **Solution of Non Linear equations** Zero's of Single transcendental equations and zero's of polynomial: Bisection Method, Iteration or Successive Approximation Method , Regula-Falsi or False Position Method, Newton Rapson Method; Rate of Convergence of iterative Methods.	30 Hours	1
II	**Solutions of Simultaneous Linear equations** Solution of System of Linear equation using Direct Method and pivoting: Gauss Elimination Method, Gauss Jordan Method, Matrix Invasion Method, ILL Conditioned System of Equations; Solution of System of Linear equation using Iterative Method: Gauss Jacobi iterative method, Gauss Seidel iterative method. **Interpolation and Approximations** Finite Difference; Difference Tables; Polynomial Interpolation for equal intervals: Newton's Forward and Backward, Central Difference Formulas: Gauss Forward and Backward Formulas, Stirling's and Bessel's Formula; Polynomial Interpolation for Unequal intervals: Lagrange's Interpolation Formula, Newton divided difference Formula.	30 Hours	1
III	**Numerical Differentiation and Integration** Numerical Differentiation of Polynomial Interpolation: Newton's Formulae, Central Difference Formulae;	30 Hours	1

	Numerical Integration: Trapezoidal Rule, Simpson's Rule, Boole's Rule, Weddle's Rule. **Solution of Ordinary Differential Equation** Introduction and Methods of Ordinary Differential Equation: Picard's Method, Euler's Method, Runge-kutta Method.		
IV	**Curve Fitting** Curve Fitting using Method of Least Squares: Fitting of Straight Line, Fitting of Polynomial, Fitting of Exponential Curves etc. **Statistics** Introduction, Review of Basic Statistics; Different Frequency Chart: Histogram, Frequency Curve, Pi-Chart etc.; Measurement of Central Tendency: Mean, Median, Mode; Measures of dispersion: Absolute Measure of Dispersion: Range, Inter Quartile Range; Relative Measure of Dispersion: Mean Deviation, Standard Deviation	30 Hours	1

Suggested Readings:

1. Shastri S.S., "Numerical Analysis", PHI.
2. Balaguruswami E, "Numerical Methods", TMH Publications.
3. Gupta S.P., "Statistical Methods", Sultan and Sons.
4. Rajaraman V., "Computer Oriented Numerical Methods", PHI.
5. Kandasamy P. "Numerical Methods", S. Chand Publications.

BCA2403: Internet & Java Programming
Course Objective:

1. To introduce the fundamental concepts of Internet Technology.
2. To develop the strong knowledge of core java programming.
3. To impart foundation and develop skills of Web Development through Java Programming.

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of java technology.
2. To develop the skills of core java programming.
3. To develop the basic knowledge of Internet Technologies.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	Internet: Introduction to internet, Connecting to Internet: Dialup Connection**,** Telephone Connection, Cable Connection, Satellite connection**,** Choosing an ISP, Internet Services**,** Internet Applications ,Internet Technologies; Client Server Model**;** Internet Addressing**,** Classes of Networks**;** Network Protocols: TCP/IP Protocols**,** FTP Protocols**,** SMTP Protocols**,** MIME Protocols; WWW**:** Browsers**,** E-mail**,** Sending & Receiving E-mails**;** Videoconferencing.	30 Hours	1
II	Introduction to Java: The JDK Directory Structure, Java History; Java Features; Structure of Java Program; Compiling and Interpreting Applications; Java Tokens; Java Character set; Keywords and Identifiers, Primitive Data types Declarations, Non-Primitive data types; Operators and Expressions; Implicit and Explicit Type Conversions: The Cast Operator; Control Statements: If-else – if statement and Switch-case; Loops: While, Do While and For; Object Oriented Concepts: Abstraction and Encapsulation, Data Hiding; Introduction to Classes and Object; Access Controls; Implementation of Inheritance and Polymorphism; Methods in Java; Access Modifiers; Constructors and its types.	30 Hours	1

III	Arrays and its type; String Handling: String Buffer; Interfaces and Abstract Classes: Defining Interfaces, Implementing and Extending Interface, Separating Interface and Implementation. Interfaces and Abstract Classes; Packages: Defining Packages, The import Statement, Package Scope, CLASSPATH and Import; Vectors class; Wrapper classes; Exception Handling: Exceptions Overview, Types of Errors, Types of Exceptions, Try, Catch and Finally Block, Defining and Throwing Exceptions; Multithreading in java: Thread and its States, Creating thread form Thread class, Creating Thread from Runable Interface, Thread control Priorities.	30 Hours	1
IV	Input/output Streams: Overview of Streams, Byte Stream: Input Stream classes, Output Stream classes; Character Stream Classes: Reader Stream Classes, Writer Stream Classes; Predefined Streams: Reading and Writing Console Input; Print Writer Class; File class; Filtered Byte Streams; Applet Basics: Types of an Applet, The Applet Class, Applet Life Cycle, Applet Tag and Adding Applet to HTML File, Passing Parameters and Running The Applet; Introduction to AWT: AWT controls, Layout managers.	30 Hours	1

Suggested Readings:

1. H. Schildt, "The Complete Reference JAVA", Seventh Edition Mc Graw Hill
2. Balagurusamy E, "Programming in JAVA",Second Edition TMH
3. Dr.C Muthu,"Programming with JAVA, Second Edition McGraw-Hill
4. CIStems School of computing Jaipur,"Internet: An Introduction"
5. R.Krishnamoorty and S.Prabhu,"Internet and Java Programming", New Age Publications
6. Udit Agrawal,"Internet and Java Programming",Dhanpat Rai & Co

BCA2404: Software Engineering
Course Objective:

1. To present the fundamental concepts of Software Engineering.
2. To make the students aware regarding the importance of various phases in Software Development.
3. To make the students learn about the various methods to deal with different stages of SDLC.
4. The subject also deals the topics like CASE Tools and SPM.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Develop the understanding of Development Life Cycle.
2. Preparation of SRS, High Level, Low Level Design and Test Cases.
3. Aware about the various types of project management activities.
4. Know how to ensure quality during software development life cycle.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Software Engineering Models** Introduction to Software Engineering; Introduction to Software; Types of software; Scope and necessity of Software Engineering; Software Components and Software Characteristics; Software Life Cycle Models: Classical Water Fall Model, Iterative Water Fall Model, Prototype Model, Evolutionary Model, Spiral Model; Comparison of different Life Cycle Models.	30 Hours	1
II	**Software Requirement Analysis and Project Planning** Requirements Analysis; Feasibility Study: Software Requirements Specification (SRS), Characteristics of SRS, Components of SRS; IEEE Standards for SRS; Project Planning; Software Cost Estimation: Basic COCOMO model, Intermediate COCOMO model, Complete COCOMO model.	30 Hours	1
III	**Software Analysis & Design** Characteristics of good software design; Cohesion and Coupling; Software design approaches; Function-Oriented Software design: Structured Analysis, Data Flow Diagrams, Structured Design; Object-Oriented Software design: Key concepts of Object-Oriented Software design, Object-Oriented Vs. Function-Oriented Software design, Graphical Representation of Object-Oriented design.	30 Hours	1
IV	**Coding, Testing and Maintenance** Introduction to Software Coding: Coding Standards and Guidelines, Code Walk-through, Code Inspections; Unit Testing; Black Box Testing; White Box Testing;	30 Hours	1

Integration Testing; System Testing; User Acceptance Testing; Roll out of Software & Deployment Issues; Software Maintenance; Need for Maintenance; Types of Software Maintenance: Corrective Maintenance, Adaptive Maintenance, Perfective Maintenance, Preventive Maintenance.		

Suggested Readings:

1. R. S. Pressman, "Software Engineering: A Practitioners Approach", McGraw Hill.
2. Rajib Mall, "Fundamentals of Software Engineering", PHI Publication.
3. Pankaj Jalote, "Software Engineering", Wiley.
4. Carlo Ghezzi, M. Jarayeri, D. Manodrioli, "Fundamentals of Software Engineering", PHI Publication.
5. Ian Sommerville, "Software Engineering", Addison Wesley.
6. Kassem Saleh,"Software Engineering", Cengage Learning.

BCA2405: Environmental Studies

BCA2451: UNIX & Shell Programming Lab

Module	Course Topics	Credits
I	Basic UNIX commands and scripts. 1. To Study Basic Unix / Linux Commands. 2. Study & use of commands for performing arithmetic operations with Unix/Linux. 3. Performing input output redirection. 4. Practicing Disk related utilities. 5. Implementing the file security using chmod, umask and sticky bit. 6. Understanding filters & pipes to perform complex taskspr, head, tail, cut, paste, sort, uniq, nl, tr, grep etc. 7. Using Regular Expressions (including basic awk programming)	1
II	Shell Programming 1. Learning vi editor 2. Writing and executing Shell script for Unix environment 3. Implementing positional parameters, shell Meta characters, argument validation in Shell scripts. 4. Shell programming- writing simple functions, basic tests, loops, patterns, expansions, substitutions 5. Writing, compiling and running a C program on Unix / Linux. 6. Implementation of eval command to handle input and output	1

BCA2452: Internet & Java Programming Lab

Module	Course Topics	Credits
I	1. Handling with Internet and its applications such as E-mail. 2. Implementation of Fundamental Data Types & Testing and Debugging of Programs. 3. Implementation of Basic Control Constructs such as loops etc 4. Implementation of Advance Control Constructs such as Arrays etc. 5. Implementation of classes & objects 6. Implementation of Methods in Java. 7. Implementation of Type Conversions. 8. Implementation of constructors. 9. Implementation of Inheritance 10. Implementation of Polymorphism. 11. Implementation of String Handling.	1
II	1. Implementation of Abstract Class, Interfaces & Packages. 2. Handling of Multiple Threads. 3. Implementation of Exception Handling. 4. Implementation of Input Output Streams. 5. Implementation of Applets for display of Images, Texts and Animations etc. 6. Use of AWT controls 7. Implementation of Event Handling 8. Use of Layout Manager for creating different applications.	1

BCA2501:.Net Framework & C#
Course Objective:

1. To present the fundamental concepts of Windows Desktop and Website development through Microsoft Technologies.
2. To impart solid foundation and develop the skill of Web Development through C# Programming.
3. To develop the concepts of static and dynamic Web Pages and make the students familiar with Client Server Technology, Distributed Applications and Web Services.

Learning Outcome: Students who have successfully completed this course will have full understanding of the following concepts:

1. Develop the understanding of .Net technology.
2. Develop the skills in ASP.NET with C# Programming.
3. Understand the Microsoft Database Connectivity.
4. Will be able to understand the Static and Dynamic web pages.
5. Will be able to understand about Distributed applications.
6. Will be able to develop a light to medium weight website.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**.Net Framework** Introduction and Origin of .Net technology, Framework Components, Common Language Runtime(CLR) and FCL, Managed and Unmanaged Code, Common Type System (CTS) & Common Language Specification (CLS), Microsoft Intermediate Language (MSIL) and Metadata, Just-In-Time Compilation (JIT), Garbage Collection, Base Classes and Ms.Net Namespaces.	30 Hours	1
II	**C# Basics** Introduction and Evolution of C#, Types, Identifiers, Variables, Constants, Literals, Type Conversion and Casting, Operators, Data Structures in C#: Enum, Arrays, ArrayList, Strings; Control Statements and Looping: If Statement, Switch Statement, For Loop, While Loop, Do While Loop, For each Loop; Object and Classes: Properties(Read, Write), Indexers, Inheritance (Multilevel and Hierarchical), Polymorphism (Operational and Inclusion), Operator Overloading, Interfaces, Delegates and Events, Boxing and Unboxing.	30 Hours	1
III	**C# Libraries and and .Net Advance Features** Input output (Streams Classes), Multithreading, Managing Consol I/O Operations, .NET Assemblies: Type of Assemblies, GAC (Global Assembly Cache), Global ASAX	30 Hours	1

	Files, State management: Session Object, Hidden Fields, View State, Cookies, Cross page posting; Web Configuration and Machine Configuration Files.		
IV	**Windows and Website Development** Windows Forms (A Skeletal Form Based Windows Program, Handling Messages, Adding a Menu and introduction and usage of various Windows Form Controls), Debugging, Exceptions and Error Handling, ASP.NET Web Form Controls (User controls and Server Controls) Web Services (UDDI, DISCO, WSDL), ADO.NET(Architecture, Difference between Dataset and Data Reader, Connection and Command Object, Distributed applications, Globalization and Localization, Authentication and Authorizations, XML in .NET	30 Hours	1

Suggested Readings:
1. Balagurusamy   Programming with c# , Tata McGraw Hill Publication.
2. ASP.NET 3.0 Black Book II, Dreamtech Press.
3. Beginning ASP.NET3.0 II, WROX Publication.
4. Stephen C. Perry, Atul Kahae, Stephen Walther, Joseph Mayo,   Essential of .NET and Related Technologies with a focus on C#, XML, ASP.net and ADO.net , Pearson, 2nd Edition, 2009.

BCA2502: Web Application Development
Course Objective:

1. To focus on the process of Web Development.
2. To build sound concepts of several languages used in Web Technology.
3. To create a dynamic, interactive website quickly, confidently and successfully.

Learning Outcome: Students who have successfully completed this course will have understanding of the following concepts:

1. Gradually build a static website using HTML, DHTML and CSS.
2. Move this skill upward by creating some degree of user interactivity using Javascript.
3. Server side data processing by creating PHP scripts and the technologies like ASP and JSP.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Internet Basic Introduction and HTML** The Basics of the Internet and IP Addressing; Overview of TCP/IP; Web Servers and Web browsers; Protocols governing the web; Introduction to HTML; HTML tags and its attributes; Text Formatting tags; Various types of Lists: Ordered, Unordered, Definition lists ;Table tags: Methods to Create Tables, Attributes of table tag, Col span and Rowspan; Frame tags and its Attributes; Form tag: Creation of Forms, Textbox, Radio Button, Hidden ,etc; Image, Anchor Tag ; Links to External Documents: Inter-page and Intra-page linking	30 Hours	1
II	**DHTML and CSS** Dynamic HTML; Features of DHTML ;CSS (Cascading Style Sheet): Font Attributes, Color and Background Attributes Text Attributes, Border, Margin related Attributes, List Attributes; Types of Style Sheet-Inline, External and Embedded; CSSP (Cascading Style Sheet Positioning); Document Object Model; JSSS (JavaScript assisted Style Sheet); Browser objects; DHTML Events	30 Hours	1
III	**Scripting languages(Javascript)** Introduction to Javascript: Advantages of Javascript, Difference between Javascript and Jscript; Basic Programming Techniques: Data Types and Literal, Creating Variables and Javascript Array; Operators and Expressions in javascript: Arithmetic Operators, Logical Operators, Comparison Operators, String Operators, Conditional Operators; Javascript Programming Constructs: Conditional checking, Loops; Functions in	30 Hours	1

	Javascript: Built in Functions and User Defined Functions; Dialog Boxes: Alert Dialog Box, Confirm Dialog Box, Prompt Dialog Box; Javascript Document Object Model (DOM):Object hierarchy in DOM, Event Handling; Form Object: Form Object's Methods and Properties, Text Element, Button Element, etc; Other Built in Objects in Javascript, String, Math and Date Object; Writing Client Side Validations from HTML Form Elements		
IV	**Server Side Scripting(JSP)** Introduction to JSP; Advantages of JSP;JSP Features; JSP Architecture; JSP Life Cycle; JSP Tags; Implicit objects in JSP: Request, Response, Out ,Session ,etc; Using HTML forms with JSP; Accessing the Database through JDBC	30 Hours	1

Suggested Readings:

1. Xavier, C, "Web Technology and Design" , New Age International Publications.
2. Bayross Ivan ,"HTML, DHTML. JavaScript, and PHP", BPB Publications, 4th Edition, 2001.
3. Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill.
4. Ramesh Bangia, "Internet and Web Design", New Age International.
5. Bhave, "Programming with Java", Pearson Education.
6. Ullman, "PHP for the Web: Visual Quick Start Guide", Pearson Education.
7. Deitel, "Java for Programmers", Pearson Education.

BCA2511: Fundamental of E Commerce

Course Objective: In this course, students will study

1. The fundamentals of the business and economic motivations for e-Commerce as well as the needs and desires of individuals.
2. The underlying computation, information and communication environments that encompass and enable e-Commerce transactions.
3. The evolving role of new highly portable, place-aware, always-with-you personal devices in e-Commerce, i.e., M-commerce.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Understand the nature and trends in e-Commerce and Mobile commerce.
2. Recognize the business impact and potential of e-Commerce.
3. Explain the technologies required to make e-Commerce viable.
4. Discuss the current drivers and inhibitors facing the business world in adopting and using e-Commerce.
5. Explain the economic consequences of e-Commerce.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Introduction and Architecture of E-Commerce** Introduction to Electronic Commerce: E-commerce, Traditional Commerce vs. E-commerce, Advantages and Disadvantages of E-commerce, Impact of E-commerce, Classification of E-commerce, Applications of E-commerce, Limitations of E-commerce, Electronic Commerce Business Models: Native Content based Model, Transplated Content Model, Native Transaction Model, Transplated Transaction Models.	30 Hours	1
II	**E-Commerce Framework and Business Security** Architectural Framework of Electronic Commerce: Network Infrastructure, Information Distribution Technology, Networked Multimedia Content Publishing Technology, Security and Encryption, Payment Services, Business Service Infrastructure, Public Policy and Legal Infrastructure, Securing the Business on Internet: Vulnerability of Information on Internet: Security Policy, Procedures and Practices, Site Security, Protecting the Network, Firewalls.	30 Hours	1
III	**Electronic Commerce Network Security & Payment System** Securing Network Transaction: Transaction Security, Cryptology, Cryptographic Algorithms, Digital Signatures, Electronic Mail Security, Security Protocols	30 Hours	1

	for Web Commerce, Electronic Payment System: Introduction to Payment Systems, Online Payment Systems, Pre-Paid Electronic Payment Systems, Postpaid Electronic Payment Systems		
IV	**Mobile Commerce: Introduction and Applications** Mobile Commerce, Benefits of Mobile Commerce, Impediments in Mobile Commerce, Mobile Commerce Payment Systems, Mobile Commerce Applications.	30 Hours	1

Suggested Readings:

1. Bharat Bhaskar, "Electronic Commerce: Framework, Technologies & Applications", TMH
2. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison-Wesley
3. Bajaj and Nag, "E-Commerce: The Cutting Edge of Business", Tata McGraw Hill
4. P. Loshin, John Vacca, "Electronic Commerce", Firewall Media, New Delhi
5. P. T. Joseph, "E-Commerce: An Indian Perspective", PHI Learning Pvt. Ltd.

BCA2512: Computer Graphics
Course Objective:
1. This course is designed to provide a comprehensive introduction to computer graphics leading to the ability to understand contemporary terminology, progress, issues, and trends.
2. It provides a goal oriented approach to discuss the fundamental principles of computer graphics, the underlying mathematics and the algorithmic aspects of the computerized image synthesis process.

Learning Outcome: Upon successful completion of the course the student will:
1. Be able to discuss and implement the application of computer graphics concepts in the development of computer games, information visualization, and business applications.
2. Be able to discuss future trends in computer graphics and quickly learn future computer graphics concepts.
3. Know and be able to select among models for lighting/shading and surfaces.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of Graphics Systems, Graphics Primitives and Scan Conversion** Classification, Characteristics, Components of Computer Graphics, Applications of Computer Graphics, Hardware devices for Computer Graphics Video Display Devices, Refresh CRT(Cathode Ray Tube),Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Direct View storage Tubes (DVST),Flat Panel Displays, Raster Scan and Random Scan Systems, Display File & Buffer, Vector & Bitmapped Images, Scan Conversion, Line Drawing Algorithms, Circle Drawing Algorithms, Text Mode & Graphics Mode, Aliasing and Anti- Aliasing	30 Hours	1
II	**2D-Transformations** & **Segments**: Geometric Transformations, Basic Transformations about origin, Translation; Scaling, Rotation, Reflection, Shearing, Combined Transformations, Scaling about an arbitrary point, Rotation about an arbitrary point, Reflection about an arbitrary Line, Segments , Segment Table, Functions for Segmenting the Display File, Default Error Conditions, Visibility	30 Hours	1

III	**Polygons, Windowing & Clipping**: Inside and outside Tests of Polygon, Even-odd Method, Winding Number Method, Polygon Filling, 4-Connected & 8-Connected Pixel Concept, Filling Algorithms, Boundary Fill Algorithm, Flood Fill Algorithm, Edge-Fill Algorithm, Fence Fill Algorithm, Viewing Transformation, Window to View Port Transformation, Clipping, Point Clipping, Line Clipping, Cohen Sutherland Algorithm, Mid-point Subdivision Algorithm, Polygon Clipping, The Sutherland-Hodgman Algorithm, Weiler-Atherton Algorithm	30 Hours	1
IV	**Multimedia System:** Introduction to Multimedia System, Applications of Multimedia, Multimedia Hardware & Software, Multimedia Building Blocks, Audio, Image, Video, Text & Animation, Multimedia Standards, MIDI , JPEG, MPEG, MHEG, Multimedia File Formats	30 Hours	1

Suggested Readings:
4. D.Hearn & M. Pauline Baker, "Computer Graphics C Version", Pearson Education.
5. Steven Harrington, "Computer Graphics: A Programming Approach", TMH.
6. Rogers, "Procedural Elements for Computer Graphics", TMH.
7. Rogers D., Adams .J, "Mathematical Elements of Computer Graphics", TMH.
8. Plastock & Kelly, "Computer Graphics; Schaum Series; McGraw Hill

BCA2513: Green Computing
Course Objective:

1. The objective of this course is to provide students with an understanding of the role of ICTs and their impact on the global carbon footprint, This includes how to estimate the carbon footprint of the ICT operations of an organization and access ways to reduce the carbon footprint by changes to policies for procurement of ICT, changes to ICT operations and revising business processes.
2. To study about existing green computing strategies, fundamental challenges in achieving green operations of computing units and directions to solve some of them.
3. This course empowers students to reduce the energy use, waste, and other environmental impacts of Information Technology (IT) systems while reducing life cycle costs, thereby improving competitive advantage. Students learn how to measure computer power usage, minimize power usage, procure sustainable hardware, design green data centers, recycle computer equipment, configure computers to minimize power, use virtualization to reduce the number of servers, and other green technologies.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Assess enterprise-wide and personal computing and computing related energy consumption.
2. Acquire expertise for improving the energy efficiency of personal computers by reducing the power consumption requirements.
3. Choose the best sustainable hardware for their applications.
4. Evaluate the regulatory and governance issues surrounding IT.
5. Recognize the necessity for long-term sustainability in IT.
6. Formulate plans for reducing IT heating and cooling requirements.
7. Execute a virtualization plan.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Politics, Science and Business of Sustainability** The Basics of Green Computing: The Energy Problem, Types of IT Energy Wastes, Reducing Energy Waste, Problem of E-waste; Legal Mandates for Green IT: Regulations in the United States, Regulations in India, Waste Electrical and Electronic Equipment (WEEE).	30 Hours	1
II	**Technical Strategy and Planning–Emerging Technology Monitoring** Energy Usage: Energy Problems (Power Supplies), Monitoring Energy Usage, Reducing Energy Usage, Low Power Computers and Components; Cooling: Cooling Costs, Reducing Cooling Costs; Energy Saving Initiatives: The Challenges of Energy Efficiencies, Energy Star, 80Plus Program, Electronic Product	30 Hours	1

	Environmental Assessment Tool (EPEAT); Document Management: The Problem with Paper, Reducing Paper Usage, Electronic Document Management.		
III	**IT Asset Disposal (E-Waste Management)** WEEE – The scale of the problem; Materials Used in Manufacturing Electrical and Electronic Products; Legislative Influences on Electronic Recycling: Producer Responsibility Legislation, The WEEE Directive, The RoHS Directive; Treatment Option for WEEE; Logistics of WEEE; Barriers to Recycling of WEEE.	30 Hours	1
IV	**Business/IS Strategy and Planning** Virtualization: Basics of Virtualization, Types of Virtualization; Improving Data Centre Energy Efficiency: Energy Consumption, Power Requirement of Equipment, Power Requirement for Cooling the Equipments; Green IT Department: The First Step – 5S, The Seven Wastes, Drawing a Process map.	30 Hours	1

Suggested Readings:

1. Toby J. Velete, Anthony T. Velete, Robert Elsenpeter - Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line; McGraw-Hill.
2. Lawrence Webber, Michale Wallace - Green Tech: How to plan and Implement Sustainable IT Solutions; AMACOM (American Management Association)
3. R E Hester, R M Harrison – Electronic Waste Management; RSC Publishing
4. John Lamb - The Greening of IT: How Companies Can Make a Difference for the Environment; IBM Press
5. Marty Poniatowski - Foundation of Green IT; Prentice Hall
6. Bhuvan Unhelkar - Green IT Strategies and Applications; CRC Press
7. Carl H. Speshock - Empowering Green Initiatives with IT; John Wiley & Sons, Inc.
8. Bill Tomlinson - Greening through IT; The MIT Press

BCA2514: E- governance
Course Objective:

1. Generating human resources with the right skills, knowledge, and aptitude and leadership qualities for effective implementation of e-Governance Projects.
2. To study about e-Governance models and its characteristics.
3. Conceptualization of ideas and development of service delivery models for improving the quality of service to citizen.
4. To make aware students about scope of e-Governance in the State through various sectors and services.

Learning Outcomes On completion of this course students will be able to:

1. Understand and critique the various roles attributable to government.
2. Explore current understandings of the relationship between public services and the rights, entitlements and responsibilities of citizens, clients and stakeholders.
3. Use terms such as 'good governance', 'accountability' and 'consultation' with a critical understanding of their meaning.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of E-Governance and its Models** Introduction to E-Governance: Needs of E-Governance, Issues in E-Governance applications and Digital Divide; Evolution of E-Governance, its scope and content; Present global trends of growth in E-Governance; Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Key areas; Towards Good Governance through E-Governance Models	30 Hours	1
II	**E-Governance Infrastructure, Strategies** E-readiness: Digital System Infrastructure, Legal Infrastructural Preparedness, Institutional Infrastructural Preparedness, Human Infrastructural Preparedness, Technological Infrastructural Preparedness; Evolutionary Stages in E-Governance;	30 Hours	1
III	**Applications of Data Mining in E-Governance** Introduction of Data warehousing and Data mining in E-Governance; National Data Warehouses: Census Data, Prices of Essential Commodities; Other areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors.	30 Hours	1
IV	**Case Studies of E-Governance in Indian perspective** • NICNET-Role of Nationwide Networking in E-	30 Hours	1

	Governance • Smart Nagarpalika-Computerization of Urban Local Bodies (Municipalities) • Ekal Seva Kendra • Aadhar • E-Suvidha • Bhulekh		

Suggested Readings:

1. C.S.R. Prabhu, "E-Governance: Concepts and Case Studies", Prentice-Hall of India Private Limited, 2004.
2. N. Gopalsamy, "Information Technology & e-Governance", New Age Publication, First Edition 2009.
3. Backus, Michiel, "e-Governance in Developing Countries", IICD Research Brief, No. 1, March 2001.
4. Subhash Bhatnagar, "Unlocking E-Government Potential: Concepts, Cases and Practical Insights", SAGE Publications India Pvt. Ltd.

BCA2504: Management Information Systems
Course Objective:

1. To understand the concept if Information Systems.
2. To learn the terminology used in the field of IT and how IT principles can apply to businesses.
3. To understand the types of Information Systems e.g., e-commerce, Enterprise Resource Planning (ERP), Decision Support Systems (DSS), Artificial Intelligence (AI) and Expert Systems (ES), SCM, CRM etc.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Understand basic information system concepts as applied to business operations and management.
2. Identify the major components of a computer system, including hardware, software, operating systems and operating environments as they apply to information systems.
3. Understand how to utilize large-scale computer applications systems to assist with business management and operations.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**An Overview of Information System** Information System Concepts: Data vs. Information, The Characteristics of Valuable Information, The Value of Information, Types of Information; System and Modeling Concepts: System Components and Concepts, System Performance and Standards, System Variables and Parameters; What is an Information System?: Input, Processing, Output , Feedback, Manual and Computerized Information System, Computer-Based Information System; Information System Classification: Operations Support Systems, Management Support Systems	30 Hours	1
II	**Concepts of Management & Organization Theory and IS Technology** Levels of management; Hierarchy of management activity; Different types of decisions; Information requirements by level of management; Types of Computer-Based Information System: Office Automation System (OAS), Transaction Processing System (TPS), Management Information System(MIS), Decision Support System (DSS), Executive Information System (EIS), Artificial Intelligence and Expert Systems *Information System Technology & Implementation* The Evolution of Information System Technology; Computer Hardware (Input, Processing, Storage & Output H/W); Computer Software (System Software, Application	30 Hours	1

	Software); Horizontal Market Application Software; Vertical Market Application Software; Custom-Developed Application Software		
III	**Management and Decision Support System** An Overview of Management Information Systems: Management Information Systems in Perspective, Inputs to a Management Information System, Outputs of a Management Information System, Characteristics of a Management Information System; Functional Aspects of the MIS: Financial Management Information Systems, Manufacturing Management Information Systems, Marketing Management Information Systems, Human Resource Management Information Systems, Other Management Information Systems; An Overview of Decision Support Systems: Characteristics of a Decision Support System, Capabilities of a Decision Support System, A Comparison of DSS and MIS; Components of a Decision Support System: The Database, The Model Base, The User Interface or Dialogue Manager; Executive Support Systems	30 Hours	1
IV	**Business Applications of Information System** Introduction to Electronic Commerce: Business-to-Business (B2B) E-Commerce, Business-to-Consumer (B2C) E-Commerce, Consumer-to-Consumer (C2C) E-Commerce; E-Commerce Challenges; Electronic Commerce Applications; Enterprise Resource Planning, Supply Chain Management, and Customer Relationship Management: An Overview of Enterprise Resource Planning, Advantages and Disadvantages of ERP Systems, ERP for Small and Medium-Size Enterprises (SMEs), Production and Supply Chain Management, Procurement Management, Customer Relationship Management and Sales Ordering, Financial and Managerial Accounting	30 Hours	1

Suggested Readings:

1. Ralph M. Stair & George W. Reynolds - Principles of Information System: A Managerial Approach; Course Technology
2. Laudon and Laudon - Management Information Systems; Pearson Education.
3. Jawadekar - Management Information Systems; Tata McGraw-Hill.
4. Davis and Olson, "Management Information Systems; Tata McGraw-Hill.
5. O'Brien - Management Information Systems; Tata McGraw-Hill.
6. D. P. Goel - Management Information System; Macmillan

BCA2515: Environmental issues of IT & e-Waste Management
Course Objective:

1. The objective of this course is to provide students with an understanding of the role of ICTs and their impact on the global carbon footprint, This includes how to estimate the carbon footprint of the ICT operations of an organization and access ways to reduce the carbon footprint by changes to policies for procurement of ICT, changes to ICT operations and revising business processes.
2. To study about existing green computing strategies, fundamental challenges in achieving green operations of computing units and directions to solve some of them.
3. This course empowers students to reduce the energy use, waste, and other environmental impacts of Information Technology (IT) systems while reducing life cycle costs, thereby improving competitive advantage. Students learn how to measure computer power usage, minimize power usage, procure sustainable hardware, design green data centers, recycle computer equipment, configure computers to minimize power, use virtualization to reduce the number of servers, and other green technologies.

Learning Outcome: After successful completion of this course, the students would be able to:

1. Assess enterprise-wide and personal computing and computing related energy consumption.
2. Acquire expertise for improving the energy efficiency of personal computers by reducing the power consumption requirements.
3. Choose the best sustainable hardware for their applications.
4. Evaluate the regulatory and governance issues surrounding IT.
5. Recognize the necessity for long-term sustainability in IT.
6. Formulate plans for reducing IT heating and cooling requirements.
7. Execute a virtualization plan.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Politics, Science and Business of Sustainability** The Basics of Green Computing: The Energy Problem, Types of IT Energy Wastes, Reducing Energy Waste, Problem of E-waste; Legal Mandates for Green IT: Regulations in the United States, Regulations in India, Waste Electrical and Electronic Equipment (WEEE).	30 Hours	1
II	**Technical Strategy and Planning–Emerging Technology Monitoring** Energy Usage: Energy Problems (Power Supplies), Monitoring Energy Usage, Reducing Energy Usage, Low Power Computers and Components; Cooling: Cooling Costs, Reducing Cooling Costs; Energy Saving Initiatives: The Challenges of Energy Efficiencies, Energy Star, 80Plus Program, Electronic Product	30 Hours	1

	Environmental Assessment Tool (EPEAT); Document Management: The Problem with Paper, Reducing Paper Usage, Electronic Document Management.		
III	**IT Asset Disposal (E-Waste Management)** WEEE – The scale of the problem; Materials Used in Manufacturing Electrical and Electronic Products; Legislative Influences on Electronic Recycling: Producer Responsibility Legislation, The WEEE Directive, The RoHS Directive; Treatment Option for WEEE; Logistics of WEEE; Barriers to Recycling of WEEE.	30 Hours	1
IV	**Business/IS Strategy and Planning** Virtualization: Basics of Virtualization, Types of Virtualization; Improving Data Centre Energy Efficiency: Energy Consumption, Power Requirement of Equipment, Power Requirement for Cooling the Equipments; Green IT Department: The First Step – 5S, The Seven Wastes, Drawing a Process map.	30 Hours	1

Suggested Readings:

1. Toby J. Velete, Anthony T. Velete, Robert Elsenpeter - Green IT: Reduce Your Information System's Environmental Impact While Adding to the Bottom Line; McGraw-Hill.
2. Lawrence Webber, Michale Wallace - Green Tech: How to plan and Implement Sustainable IT Solutions; AMACOM (American Management Association)
3. R E Hester, R M Harrison – Electronic Waste Management; RSC Publishing
4. John Lamb - The Greening of IT: How Companies Can Make a Difference for the Environment; IBM Press
5. Marty Poniatowski - Foundation of Green IT; Prentice Hall
6. Bhuvan Unhelkar - Green IT Strategies and Applications; CRC Press
7. Carl H. Speshock - Empowering Green Initiatives with IT; John Wiley & Sons, Inc.
8. Bill Tomlinson - Greening through IT; The MIT Press

BCA2516: Digital Governance
Course Objective:

1. Generating human resources with the right skills, knowledge, and aptitude and leadership qualities for effective implementation of e-Governance Projects.
2. To study about e-Governance models and its characteristics.
3. Conceptualization of ideas and development of service delivery models for improving the quality of service to citizen.
4. To make aware students about scope of e-Governance in the State through various sectors and services.

Learning Outcomes On completion of this course students will be able to:

1. Understand and critique the various roles attributable to government.
2. Explore current understandings of the relationship between public services and the rights, entitlements and responsibilities of citizens, clients and stakeholders.
3. Use terms such as 'good governance', 'accountability' and 'consultation' with a critical understanding of their meaning.

Course Contents:

Module	Course Topics	Total Hours	Credits
I	**Overview of E-Governance and its Models** Introduction to E-Governance: Needs of E-Governance, Issues in E-Governance applications and Digital Divide; Evolution of E-Governance, its scope and content; Present global trends of growth in E-Governance; Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Key areas; Towards Good Governance through E-Governance Models	30 Hours	1
II	**E-Governance Infrastructure, Strategies** E-readiness: Digital System Infrastructure, Legal Infrastructural Preparedness, Institutional Infrastructural Preparedness, Human Infrastructural Preparedness, Technological Infrastructural Preparedness; Evolutionary Stages in E-Governance;	30 Hours	1
III	**Applications of Data Mining in E-Governance** Introduction of Data warehousing and Data mining in E-Governance; National Data Warehouses: Census Data, Prices of Essential Commodities; Other areas for Data Warehousing and Data Mining: Agriculture, Rural Development, Health, Planning, Education, Commerce and Trade, Other Sectors.	30 Hours	1
IV	**Case Studies of E-Governance in Indian perspective** • NICNET-Role of Nationwide Networking in E-	30 Hours	1

	Governance		
	• Smart Nagarpalika-Computerization of Urban Local Bodies (Municipalities) • Ekal Seva Kendra • Aadhar • E-Suvidha • Bhulekh		

Suggested Readings:

1. C.S.R. Prabhu, "E-Governance: Concepts and Case Studies", Prentice-Hall of India Private Limited, 2004.
2. N. Gopalsamy, "Information Technology & e-Governance", New Age Publication, First Edition 2009.
3. Backus, Michiel, "e-Governance in Developing Countries", IICD Research Brief, No. 1, March 2001.
4. Subhash Bhatnagar, "Unlocking E-Government Potential: Concepts, Cases and Practical Insights", SAGE Publications India Pvt. Ltd.

BCA2551:.Net Framework & C# Lab

Module	Course Topics	Credits
I	**Basic .Net and C#** 1. Implementation of Decision Making and Branching Statements on Console Applications. 2. Implementation of Iterative Statements on Console Applications. 3. Implementation of Arrays on console Applications. 4. Implementation of Strings on Console Applications.	1
II	**Object Oriented** 1. Implementation of Inheritance and Polymorphism on Console Applications. 2. Implementation of Interfaces on Console Applications. . Implementation of Events on Console Applications. 3. Construct the C# console application to implement the Operator Overloading. 4. Implementation of Delegates on Console Applications. 5. Implementation of server side controls in asp.net. 6. Implementation of database Connectivity in Asp.Net.	1

BCA2552: Web Application Development Lab

Module	Course Topics	Credits
I	1. Implementation of List Tags in HTML. 2. Implementation of Table Tag in HTML. 3. Implementation of Frame Tag in HTML. 4. Implementation of Form Tags in HTML. 5. Implementation of CSS (Inline, External and Embedded) in DHTML. 6. Implementation of Class Concept in DHTML. 7. Implementation of DHTML Events.	1
II	1. Implementation of basic variables in Java Script. 2. Implementation of User Defined Functions in Java Script. 3. Implementation of inbuilt functions in Java Script. 4. Implementation of Form validation in Java Script. 5. Implementation of Basic Features of JSP. 6. Implementation of Various Events and methods of Request and Response Object in JSP. 7. Implementation of Database Access through HTML Forms in JSP. 8. Implementation of JAVA API in JSP.	1