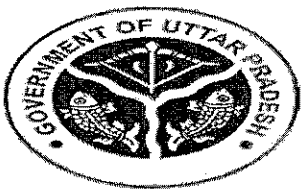
Undergraduate (UG) Computer Science SYLLABUS

(As per NEP2020)

Bachelor of Science (B.Sc.)

(Computer Science as major subject)



Department of Computer Science

Dr. Shakuntala Misra National Rehabilitation University, Lucknow, U.P. India, 226017

Course Structure for B.Sc. Computer Science Major

SEMESTER-WISE TITLES OF THE PAPERS IN UG COMPUTER SCIENCE COURSE			
YEAR	**COURSE CODE**	**PAPER TITLE**	**CREDIT**
First Year		**Semester-I**	
	BSCS101	Problem Solving using Computer	2
	BSCS102	Software Lab using Python	1
	Other Subject		3
	Other Subject		3
	PHY104 MDE-1 Elective	Basics of Physics (To be offered by Physics Department)	3
	SEC-1 Other subject	(To Be Offered By Stats Department)	3
	AEC-1	(To Be Offered By .....Department)	2
	VAC-1	Environmental Science (To be offered by Physics Department)	3
	Total		20
		Semester-II	
	BSCS103	Database Management Systems	2
	BSCS104	Database Management Systems Lab	1
	Other Subject (Major)		3
	Other Subject (Major)		3
	(MDE-2) Other Subject	(To Be Offered By Stats Department)	3
	BSCS105 SEC-2 Other Subject	Office Productivity Tool And Digital Workplace Skills.	3
	AEC-2		2
	VAC-2		3
	Total		20

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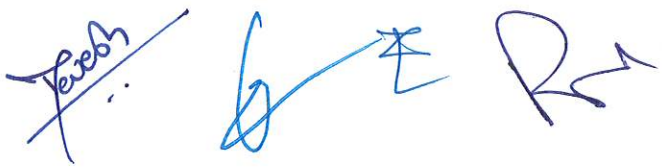
Second Year	**Semester-III**		
	BSCS201	Operating Systems	3
	BSCS202	Operating Systems Lab	1
	Other Subject		4
	Other Subject		4
	BSCS203 (MDE-3)	E-Commerce	3
	PHY-204 SEC-1	Basic Instrumentation in Physics (To be offered by Physics Department)	3
	AEC-3		2
	Total		20
	Semester-IV		
	BSCS204	Computer System Architecture	3
	BSCS205	Computer System Architecture Lab	1
	BSCS206	System Analysis & Design	2
	Other Subject (Major)		6
	Other Subject (Major)		6
	AEC-4		2
	Total		20



Third Year	**Semester-V**		
	BSCS301	Analysis of Algorithms and Data Structures	2
	BSCS302	Soft **Computing**	2
	BSCS303	Lab on Algorithms and Data Structures with C++	1
	BSCS304	Project-I	1
	Other Subject (Major)		6
	Minor Course (Other faculty)		4
	Internship Summer term		4**
	Total		20
	Semester-VI		
	BSCS305	Data Communication and Computer Networks	3
	BSCS306	Cyber Security & Cyber Laws	3
	BSCS307	Lab on Computer Networks	1
	BSCS308	Project-II	1
	Other Major Subject		8
	(Other Faculty) Minor Subject		4
	Total		20

Fourth Year			
	Semester-VII		
	BSCS401	Software Engineering	3
	BSCS402	Web Technologies	3
	BSCS403	Artificial Intelligence	3
	BSCS404	Cloud Computing	3
	BSCS405	Web Technologies lab	2
	BSCS406	Artificial Intelligence lab	2
	Minor Course Other Faculty		4
	BSCS407	Research Project** (will be evaluated in semester VIII)	6
	Total		20
	Semester-VIII		
	BSCS408	Machine Learning	3
	BSCS409	Machine Learning Lab	1
	BSCS410	Research Project** (will be evaluated in semester VIII)	6+6
	Other Faculty Minor Courses		4
		Total	20

BSCS101: Problem Solving using Computer

Course Specific Outcomes: On completing this course, a student will have:

- Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
- Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
- Develops the ability to analyze a problem, develop an algorithm to solve it.
- Develops the use of the Python programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.

UNIT I: Computer Fundamentals: Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers. Basic Computer Organization - Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices. Planning the Computer Program: Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.

UNIT II: Techniques of Problem Solving: Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming. Overview of Programming: Structure of a Python Program, Elements of Python, IDEs for python, Python Interpreter, Using Python as calculator, Python shell, Indentation.

UNIT III: Introduction to Python: Atoms, Identifiers and keywords, Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment or Decrement operator). Creating Python Programs: Input and Output Statements, Control statements (Looping- while Loop, for Loop, Loop Control, Conditional Statement- if...else, Difference between break, continue and pass).

UNIT IV: Structures: Numbers, Strings, Lists, Tuples, Dictionary, Date & Time, Modules, Defining Functions, Exit function, default arguments. File handling in python. Introduction to Advanced Python: Objects and Classes, Inheritance, Regular Expressions, Event Driven Programming, GUI Programming. Basic concepts of concepts of Package and modules

References:

- P. K. Sinha & Priti Sinha , "Computer Fundamentals", BPB Publications, 2007.
- Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
- T. Budd, Exploring Python, TMH, 1st Ed, 2011
- Python Tutorial/Documentation www.python.or 2010
- Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computer scientist : learning with Python , Freely available online.2012
- Rober Sedgewick, K Wayne -Introduction to Programming in Python: An interdisciplinary Approach" Pearson India

BSCS103: DATABASE MANAGEMENT SYSTEMS

Course Specific Outcomes: On completing this course, a student will have:

- Understands the basic concepts of data base management systems.
- Design E-R diagrams for real world applications.
- Formulate relational algebraic expressions using relational data models and languages.
- Apply normalization transaction properties and concurrency control to design database.
- Analise the security algorithms for database protection.

UNIT I: Introduction: Database System Concepts, File system vs. database system, Database system architecture, Data models and their types, Data base scheme and instances, Data independence, Database Languages and Interfaces. Data Modelling Concepts: ER model concepts: Notations for ER diagram, Extended E-R diagram, Extended E-R model, E-R model design issues, constraints, and keys: Weak entity set strong entity set, Relationships of higher degree.

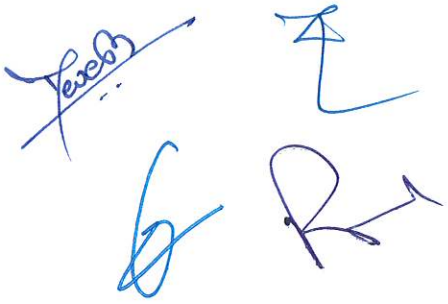
UNIT II: Relational model concepts: code rules, constraints, Relational Algebra operations, Extended relational algebra operations, Relational Calculus, Tuple and Domain relational calculus. Database Design: Functional dependencies, Normal forms, First, second, and third normal forms, BCNF, Multi-valued dependencies and Fourth Normal form, Join Dependencies and Fifth Normal form.

UNIT III: Transaction, Query Processing: Transaction and system concepts: transaction states, ACID properties of transactions, concurrent execution schedules and Recoverability, Serializability of schedules. Query Processing and Optimization: Measures of Query cost, Cost, Evaluation of expression. Optimization: Transformation of relational expression, Choice of evaluation plan. Concurrency Control: Concurrency Control Techniques: Two phase Locking Techniques for Concurrency Control; Time stamping in Concurrency control.

UNIT IV: Introduction to SQL: Basic Structure of SQL Query, set operators, SELECT, UNION, INTERSECT, and EXCEPT, Nested queries, Aggregate function, Null values, Derived Relations, Modification of the Database, Joined relations and up-dates in SQL. Database Security: Importance of data, Threats and risks, Users and database privileges, Access Control, Security for Internet Applications, Role of Database Administrator.

References:

- Henry F. Korth and Abraham Silberschatz, "Database System Concepts," Second Edition, McGraw Hill, 1991.
- AtulKahate, "Introduction to Database Management Systems," Pearson India, 2004.
- Raghu Ramakrishnan and Johannes Gehrike, "Database Management Systems," Third McGraw Hill, Edition, 2003.
- R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and application Programming, 6 Edition, Pearson Education,2013.
- A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition, McGraw Hill, 2010.
- C.J Date " An Introduction to Database Systems", Addison Wesley



BSCS105: OFFICE PRODUCTIVITY TOOL AND DIGITAL WORKPLACE SKILLS

Course Specific Outcomes:

- Create, format, and manage professional documents using word processing tools.
- Analyze, organize, and visualize data effectively using spreadsheets.
- Design engaging presentations for academic or professional use.
- Improve productivity through task management, collaboration, and communication tools.
- Automate repetitive tasks and organize digital files efficiently.

Unit 1: Introduction to Word Processing, Understanding the interface and tools in Microsoft Word and Google Docs, Creating, saving, and managing documents, Document Formatting and Styles, Font styles, paragraph alignment, margins, and spacing, Using headers, footers, page numbers, and columns, Inserting tables, images, charts, hyperlinks, and comments, Using themes, styles, and templates, Collaboration and Sharing, Real-time collaboration using Google Docs

Unit 2: Introduction to Spreadsheets, Navigating Microsoft Excel/Google Sheets interfaces, Basic data entry, formatting, and cell referencing, Basic Formulas and Functions, Arithmetic operations (SUM, AVERAGE, MIN, MAX), Logical functions (IF, COUNTIF, VLOOKUP), Data Organization and Filtering, Sorting and filtering data, Using tables and conditional formatting, Data Visualization, Creating charts and graphs (bar charts, pie charts, line graphs), Adding trends and analyzing visual data ,Hands-on Project:

Unit 3: Introduction to Presentation Tools, Navigating Microsoft PowerPoint and Google Slides interfaces, Creating and managing slides, Slide Design and Content Development, Adding text, images, charts, audio, and videos, Design principles: themes, fonts, layouts, and colors, Animations, Transitions, and Interactivity, Adding animations, transitions, and hyperlinks for flow, Creating interactive presentations for different audiences, Collaboration and Delivery, Real-time collaboration on slides

Unit 4: Email and Calendar Management (Outlook/Gmail), Writing professional emails, using attachments, and email etiquette, Managing tasks, reminders, and shared calendars, Task and Workflow Automation, Introduction to task management tools: Microsoft To-Do, Trello, or Asana, Automating repetitive tasks using Microsoft Power Automate or Zapier, File Management and Cloud Storage, Organizing files and folders, Using cloud tools like OneDrive, Google Drive, and Dropbox for storage

and sharing, Digital Collaboration Tools, Introduction to Microsoft Teams and Google Workspace for group work,File sharing, virtual meetings, and document collaboration.

References:

- P. K. Sinha & Priti Sinha , "Computer Fundamentals", BPB Publications, 2007.
- Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
- Dinesh Maidasani, Fundamentals of Information Technology including MS-Office, 2010, Laxmi Publication, New Delhi 2. Taxali RK, P
- C Software for Windows, , TATA Mcgraw Hill, New Delhi

BSCS201: OPERATING SYSTEMS

Course Specific Outcomes: On completing this course a student will have:

- Understand role, responsibilities, features, and design of operating system.
- Analyze memory management schemes and process scheduling algorithms.
- Apply process synchronization techniques to formulate solution for critical section problems.
- Illustrate concept of disk scheduling.
- Evaluate process deadlock handling techniques.

UNIT I: Introduction Operating system and functions, Classification of Operating systems: Batch, Interactive, Time-sharing, Real-Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, Operating System Structure, System Components, Operating System Services, Kernels, Monolithic and Microkernel Systems. Process Management: Process Concept, Process States, Process Synchronization, Critical Section, Mutual Exclusion, Classical Synchronization Problems, Process Scheduling, Process States, Process Transitions, Scheduling Algorithms Inter-Process Communication, Threads and their management, Security Issues.

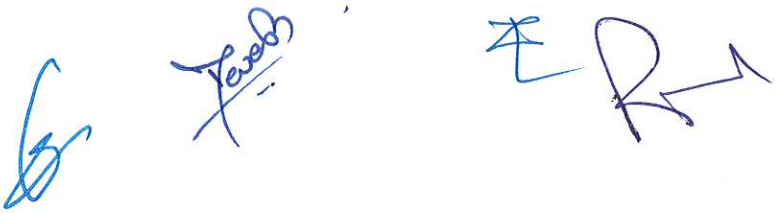
UNIT II: CPU Scheduling: Scheduling Concepts, Techniques of Scheduling, Pre-emptive and Non- Pre-emptive Scheduling: First-Come-First-Serve, Shortest Request Next, Highest Response Ration Next, Round Robin, Least Complete Next, Shortest Time to Go, Long, Medium, Short Scheduling, Priority Scheduling. Deadlock: System model, Deadlock characterization, Prevention, Avoidance and detection, Recovery from deadlock. Memory Management: Memory allocation, Relocation, Protection, Sharing, Paging, Segmentation, Virtual Memory, Deman Paging, Page Replacement Algorithms, Thrashing.

UNIT III: I/O Management and Disk Scheduling: I/O devices, and I/O subsystems, I/O buffering, Disk storage and disk-scheduling, RAID. File System: File concept, File organization and access mechanism, File directories, and File sharing, File system implementation issues, File system protection and security.

UNIT IV: Shell introduction and Shell Scripting: What is shell and various type of shell, Various editors present in linux, Different modes of operation in vi editor, What is shell script, Writing and executing the shell script, Shell variable (user defined and system variables) System calls, Using system calls, Pipes and Filters, Decision making in Shell Scripts (If else, switch), Loops in shell, Functions, Utility programs (cut, paste, join, tr , uniq utilities), Pattern matching utility (grep)

References:

- Andrew S. Tanenbaum and Herbert Bos,"Modern Operating Systems," Fourth Edition, Pearson, 2014.
- Abraham Silberschatz, Greg Gagne, and Peter B. Galvin, "Operating System Concepts," Tenth Edition, Wiley, 2018.
- William Stallings, "Operating Systems: Internals and Design Principles," Seventh Edition, Prentice Hall, 2011.
- Dhanjay Dhamdhere, "Operating Systems," First Edition, McGraw-Hill, 2008
- Milan Milankovic "Operating systems, Concepts and Design" McGraw Hill



BSCS203: E-COMMERECE

Course Specific Outcomes:

- Analyze the impact of E-commerce on business models and strategy.
- Describe the major types of E-commerce.
- Explain the process that should be followed in building an E-commerce presence.
- Identify the key security threats in the E-commerce environment.
- Describe how procurement and supply chains relate to B2B E-commerce.

Unit 1 Introduction to Electronic Commerce – E-Commerce Framework- Anatomy of E-Commerce Applications – E-Commerce Consumer & Organization Applications- E- Commerce and World Wide Web – Internet Service Providers – Architectural Framework for Electronic Commerce – WWW as the Architecture- Hypertext publishing.

Unit 2 Electronic Payment Systems – Types of Electronic Payment Systems – Digital Token Based Electronic Payment System – Smart Cards – Credit Cards – Risk in Electronic Payment Systems – Designing Electronic Payment Systems

Unit 3 Electronic Data Interchange, EDI Applications in Business, EDI implementation, MIME, and value added networks Work flow automation and Coordination, Customization and Internal Commerce, Supply Chain Management (SCM).

Unit 4 Corporate Digital Library – Document Library, Digital Document Types, Corporate Data Warehouse, Advertising and Marketing – Information based Marketing, Advertising on Internet, On-Line Marketing Process, Market Research.

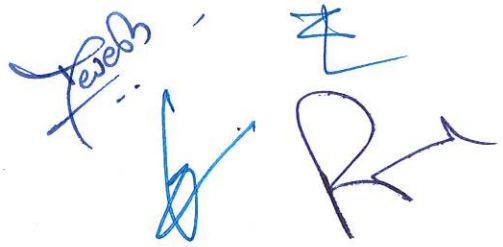
Unit 5 Consumer Search and Resource Discovery – Information Search and Retrieval, Commerce Catalogues, Information Filtering Multimedia – Key Multimedia Concepts, Digital Video and Electronic Commerce, Desktop Video Processing.

Suggested Books:

1. Ravi Kalakota & A. B. Whinston - "Frontiers of Electronic Commerce", Pearson Education, India, 1999.
2. Daniel Minoli, Emma Minoli: "Web Commerce Technology Handbook", Tata McGraw Hill

3. Bajaj and Nag. "E-Commerce the cutting edge of Business". TMH.

4. E-Business & Commerce: Brahm Cazner, Wiley dreamtech.



BSCS204: COMPUTER SYSTEM ARCHITECTURE

Course Specific Outcomes:

- The student will be able to understand the basic arithmetic of a Computer System; how the data is represented,
- how the various operation are performed on the data, the basic circuits to perform these operations,
- how instructions are formatted and how these instructions are executed to accomplish a particular operation.
- Student can also learn the organization of the peripheral devices, the interface between these devices to the system.
- Student can also understand the architecture of a basic computer, its registers, bus system and the interaction flow among them.

UNIT I: Data Representation and basic Computer Arithmetic: Number systems, complements, fixed and floating point representation, character representation, addition, subtraction,magnitude comparison.Logic gates and circuits: logic gates, boolean algebra, combinational circuits, circuit simplification, introduction to flip-flops and sequential circuits, decoders, multiplexers,registers, counters.

UNIT II:. Basic Computer Organization and Design: Computer registers, bus system, instruction set, timing and control, instruction cycle, memory reference, input-output and interrupt. Central Processing Unit: Register organization, arithmetic and logical micro-operations, stack organization, Hardwired vs. micro programmed control. Pipeline control: Instruction pipelines, pipeline performance, super scalar processing, Pipelining, RISC & CISC

UNIT-III: Programming the Basic Computer: Instruction formats, addressing modes, instruction codes, assembly language Memory Organization: Memory device characteristics, random access memories, serial access memories, Multilevel memories, address translation, memory allocation, Main features, address mapping, structure versus performance.

UNIT IV: Input-output Organization: Peripheral devices, I/O interface, Modes of data transfer: Programmed, Interrupt Driven and Direct Memory Access. Parallel processing: Processor-level parallelism, multiprocessor architecture

References:

- M. Mano, "Computer System Architecture", Pearson Education, New Jersey, 2017,Third Edition.
- W. Stallings, "Computer Organization and Architecture Designing for Performance",Prentice Hall of India, 2015, Tenth Edition.
- M. Mano, "Digital Design", Pearson Education, New Jersey, 2018, Sixth Edition.
- Vranasic and Hamacher, Computer Organization, TMH"

BSCS206: SYSTEM ANALYSIS AND DESIGN

Course Specific Outcomes:

- Learn the purpose and phases of the systems development life cycle (SDLC).
- Assess the tools and techniques used in systems analysis and design.
- Analyze case studies to understand real-world aspects of systems analysis and design.
- Analyze and use a popular systems development process.
- Evaluate system support models and describe methods for securing systems.

Unit 1 System: Definition, Characteristics, Elements and types of system. System Development Life Cycle, Role of system analyst, Initial investigation, Feasibility study-Technical, economic and behavioral, feasibility, Cost and Benefit analysis.

Unit 2 System Analysis: Problem Definition, Information requirements, Information gathering tools, Tools of structured Analysis-Data Flow Diagrams

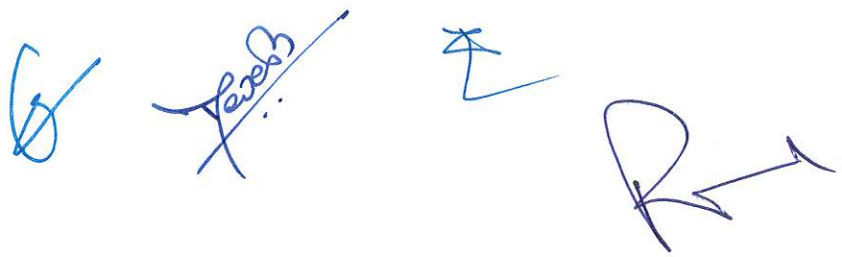
Unit 3 Data Dictionary, Decision Tree, Decision tables and structured English.

Unit 4 System Design: Structured Design, Input design, and Output design, Form Design. File Organization: Sequential Indexed Sequential, Chaining and Inverted list organization. System Testing: Test Plan AND test data, types of system test.

Unit 5 System Implementation: Implementation Plan, activity network for conversion, combating resistance to change. Hardware/ Software Selection: Procedure for selection, Major phases in selection, Make V/s buy decision, Criteria for software selection.

Suggested Books:

1. Awad, EM: System Analysis and Design, Galgotia Publications Pvt. Ltd.
2. Gane and Sarson: Structured System Analysis and Design.
3. Silver, GA, Silver, ML: System Analysis and Design, Addison-Wesley Publishing Co.



BSCS301: ANALYSIS OF ALGORITHM AND DATA STRUCTURES

Course Specific Outcomes: On completing this course a student will have:

- Understand that various problem-solving categories exist such as; iterative technique, divide and conquer, dynamic programming, greedy algorithms, and understand various searching and sorting algorithms
- Employ a deep knowledge of various data structures when constructing a program.
- Design and construct simple object-oriented software with an appreciation for data abstraction and information hiding.
- Effectively use software development tools including libraries, compilers, editors, linkers and debuggers to write and troubleshoot programs.

UNIT I: Introduction: Basic Design and Analysis techniques of Algorithms, time and space complexity, Correctness of Algorithm, Algorithm Design Techniques: Iterative techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms. Sorting Techniques: Elementary sorting techniques-Bubble Sort. Insertion Sort, Merge Sort, Advanced Sorting Techniques-Heap Sort, Quick Sort, Sorting in Linear Time- Bucket Sort, Radix Sort and Count Sort

UNIT II: Searching Techniques and Complexity Analysis: Linear and Binary search, Medians & Order Statistics. Arrays: Single and Multi-dimensional Arrays, Sparse Matrices;

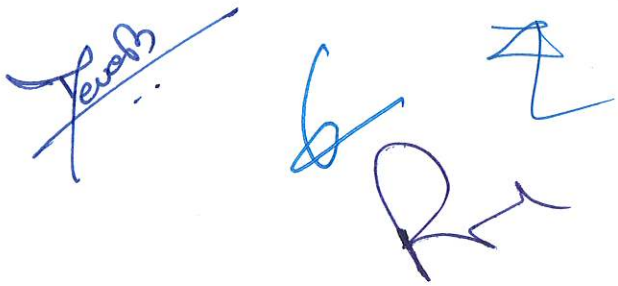
UNIT III: Stacks and Queues: Implementing stack using array and linked list, Prefix, Infix and Postfix expressions, Utility and conversion of these expressions from one to another; Array and Linked representation of Queue, De-queue, Priority Queues Linked Lists: Singly, Doubly and Circular Lists, representation of Stack and Queue as Linked Lists.

UNIT IV: Recursion: Developing Recursive Definition of Simple Problems and their implementation; Advantages and Limitations of Recursion; Trees: Introduction to Tree as a data structure; Binary Trees, Binary Search Tree, (Creation, and Traversals of Binary Search Trees)

References:

- Cormen T.H., Leiserson Charles E., Rivest Ronald L., Stein Clifford, Introduction to Algorithms, PHI Learning Pvt. Ltd., 2009, 3rd Edition.
- Basse Sara & A.V. Gelder, Computer Algorithm: Introduction to Design and Analysis, Pearson, 2000, 3rd Edition.

- Drozdek Adam, "Data Structures and algorithm in C++", Cengage Learning, 2012, Third Edition.
- Tenenbaum Aaron M., Augenstein Moshe J., Langsam Yedidyah, "Data Structures Using C and C++, PHI, 2009, Second edition.
- Kruse Robert L., "Data Structures and Program Design in C++", Pearson.



BSCS302: SOFT COMPUTING

Course Specific Outcomes:

- Upon the completion of this course the student will have the knowledge of soft computing concepts and he can apply them for practical applications.
- He would be able to choose and design suitable Neural Network for real time problems.
- He can appropriately use fuzzy rules and reasoning to develop decision making and expert systems.
- He would know the importance of optimization techniques and genetic programming.

UNIT I: Introduction To Neural Networks: Neural Networks Neuron, Nerve Structure And Synapse, Artificial Neuron And Its Model, Activation Functions. Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Perception And Convergence Rule. Supervised Learning Network& Unsupervised Learning Network.

UNIT II: Back Propogation Networks: Perceptron Model, Solution, Single Layer, Multilayer Perception Model. Back Propogation Learning Methods, Effect of Learning Rule Co-Efficient. Back Propagation Algorithm, Applications.

UNIT III: Fuzzy Logic Introduction: Basic Concepts Of Fuzzy Logic, Fuzzy Sets And Crisp Sets, Fuzzy Set Theory And Operations, Properties Of Fuzzy Sets Fuzzy And Crisp Relations, Fuzzy To Crisp Conversion, Membership Functions, Interference In Fuzzy Logic, Fuzzy If-Then Rules, Fuzzifications & Defuzzification's.

UNIT IV: Genetic Algorithm: Basic Concepts, Working Principle, Procedures Of GA, Flow Chart Of GA. Genetic Representations, (Encoding), Genetic Operators, Mutation, Generational Cycle.

References:

- S. Rajsekaran& G.A. VijayalakshmiPai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India,2003
- Anderson, James, "Introduction to Neural Networks", PHI Publication, Delhi, India
- N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press, USA, 2005.
- Simon Haykin,"Neural Netowrks and Learning Machines "Prentice Hall of India, 2005, Third Edition

BSCS305: DATA COMMUNICATION AND COMPUTER NETWORK

Course Specific outcomes:

- To develop understanding of computer networks and communication basics.
- To understand design issues and services at different layers of reference models.
- To learn various error detection/correction techniques, routing protocols, congestion control algorithms, and connection establishment/release.
- To describe and analyse related technical, administrative, and social aspects of networking.

UNIT I: Introduction to Signals: Data and Information, Data communication, Characteristics of data communication, Components of data communication, Data Representation, Data Flow, Simplex, Half Duplex, Full Duplex, Analog and Digital Signals, Periodic and Aperiodic signals, Time and Frequency Domain, Composite Signals Basic concepts of Networks: Components of data communication, standards and organizations, Network Classification, Network Topologies. network protocol; layered network architecture. overview of OSI reference model; overview of TCP/IP protocol suite.

UNIT II: Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway. Data Link Layer: Designing issues, Framing and Data Link Control, Error detection schemes (parity, checksums, CRCs), Error correction schemes (Hamming codes, binary convolution codes), Data link layer protocols (Simplest, Stop & Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Sliding Window), MAC sublayer (Ethernet, ALOHA, CSMA family, Contention-free access/Token Ring).

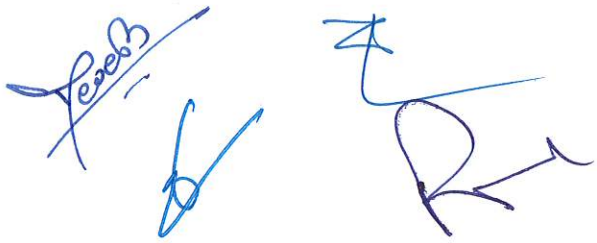
UNIT III: Network Layer: Design issues, Switching, Routing algorithms (Shortest path, Link state, Flooding, Broadcast, Multicast), Packet Scheduling, Internetworking, Internet Protocol (IPv4, IPv6), IP addressing, Internet Control Protocols (IMCP, ARP, DHCP), Mobile IP.

Transport Layer: Transport layer services, Connection establishment and teardown, TCP, UDP, Congestion Control, Quality of Service, Domain Name System, World Wide Web.

UNIT IV: Application Layer: Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP, SMTP. Network Security: Common Terms, Firewalls, Virtual Private Networks

References:

- Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks," Fifth Edition, Pearson, 2014.
- William Stallings, "Data and Computer Communications", Tenth Edition, Pearson, 2013.
- Behrouz A. Forouzan, "Data Communications and Networking," Fourth Edition, McGraw-Hill Higher Education, 2007



BSCS306: CYBER SECURITY & CYBER LAWS

Course Specific Outcomes: On completing this course a student will have:

- Understand types of information, cyber threats, and national/international cyber security standards.
- Do mathematical modeling and development of security techniques and information system.
- Develop understanding of legal issues related to cyber security.
- Apply ethical principles/responsibilities in cyber practices.

UNIT I: Introduction: Introduction to Information System, Type of information system, Development of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, Business need, Ethical and Professional issues of security. Information Security Model, Component of an Information security, Aspect of information security, Security attacks (Active and Passive Attacks), Security mechanism and Security Services (X.800).

UNIT II: Information Security Techniques, Introduction to Cryptography: Terminology, cryptanalysis, Security of algorithms, Substitution Cipher and Transposition Cipher, Single XOR, One-way Pad, Cryptographic Protocols-I: Arbitrated and Adjudicated Protocol, One- Way Hash function,

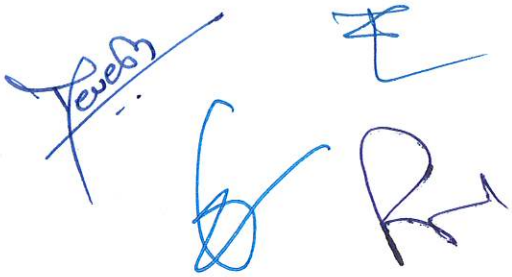
UNIT III: Cryptographic Protocols-II: Public key cryptography, Digital Signature, Digital Watermarking Technique: Characteristics and Types. Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies- Sample Security Policies.

UNIT IV: Cyber Laws: Information Security Standards, IT act 2000 Provisions, Introduction to digital laws, cyber laws, intellectual property rights, copyright laws, patent laws, software license.

References:

- Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017.
- Douglas J. Landoll, "Information Security Policies, Procedure, and Standards: A Practitioner's Reference," CRC Press, 2016.
- Harold F. Tipton, and Micki Krause, "Hand book of information security management," Sixth Edition, Archtech Publication, 2007.

- William Stallings, "Cryptography and Network Security: Principles and Practice," Sixth Edition, Pearson, 2014.



BSCS305: DATA COMMUNICATION AND COMPUTER NETWORK

Course Specific outcomes: On completing this course a student will have:

- To develop understanding of computer networks and communication basics.
- To understand design issues and services at different layers of reference models.
- To learn various error detection/correction techniques, routing protocols, congestion control algorithms, and connection establishment/release.
- To describe and analyse related technical, administrative, and social aspects of networking.

UNIT I: Introduction to Signals: Data and Information, Data communication, Characteristics of data communication, Components of data communication, Data Representation, Data Flow, Simplex, Half Duplex, Full Duplex, Analog and Digital Signals, Periodic and Aperiodic signals, Time and Frequency Domain, Composite Signals Basic concepts of Networks: Components of data communication, standards and organizations, Network Classification, Network Topologies. network protocol; layered network architecture. overview of OSI reference model; overview of TCP/IP protocol suite.

UNIT II: Physical Layer: Cabling, Network Interface Card, Transmission Media Devices- Repeater, Hub, Bridge, Switch, Router, Gateway. Data Link Layer: Designing issues, Framing and Data Link Control, Error detection schemes (parity, checksums, CRCs), Error correction schemes (Hamming codes, binary convolution codes), Data link layer protocols (Simplest, Stop & Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Sliding Window), MAC sublayer (Ethernet, ALOHA, CSMA family, Contention-free access/Token Ring).

UNIT III: Network Layer: Design issues, Switching, Routing algorithms (Shortest path, Link state, Flooding, Broadcast, Multicast), Packet Scheduling, Internetworking, Internet Protocol (IPv4, IPv6), IP addressing, Internet Control Protocols (IMCP, ARP, DHCP), Mobile IP.

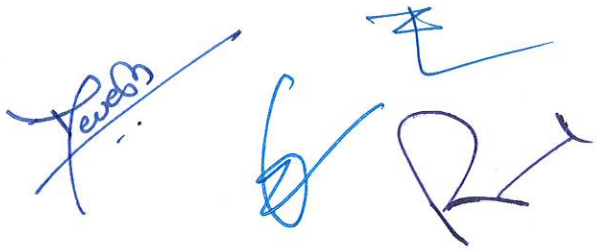
Transport Layer: Transport layer services, Connection establishment and teardown, TCP, UDP, Congestion Control, Quality of Service, Domain Name System, World Wide Web.

UNIT IV: Application Layer: Application layer protocols and services – Domain name system, HTTP, WWW, telnet, FTP, SMTP. Network Security: Common Terms, Firewalls, Virtual Private Networks

References:

- Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks," Fifth Edition, Pearson, 2014.

- William Stallings, "Data and Computer Communications", Tenth Edition, Pearson, 2013.
- Behrouz A. Forouzan, "Data Communications and Networking," Fourth Edition, McGraw-Hill Higher Education, 2007



BSCS306: CYBER SECURITY & CYBER LAWS

Course Specific Outcomes: On completing this course a student will have:

- Understand types of information, cyber threats, and national/international cyber security standards.
- Do mathematical modeling and development of security techniques and information system.
- Develop understanding of legal issues related to cyber security.
- Apply ethical principles/responsibilities in cyber practices.

UNIT I: Introduction: Introduction to Information System, Type of information system, Development of information system, CIA model of Information Characteristics, Introduction to Information Security, Need of Information Security, Cyber Security, Business need, Ethical and Professional issues of security. Information Security Model, Component of an Information security, Aspect of information security, Security attacks (Active and Passive Attacks), Security mechanism and Security Services (X.800).

UNIT II: Information Security Techniques, Introduction to Cryptography: Terminology, cryptanalysis, Security of algorithms, Substitution Cipher and Transposition Cipher, Single XOR, One-way Pad, Cryptographic Protocols-I: Arbitrated and Adjudicated Protocol, One- Way Hash function,

UNIT III: Cryptographic Protocols-II: Public key cryptography, Digital Signature, Digital Watermarking Technique: Characteristics and Types. Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate policies- Sample Security Policies.

UNIT IV: Cyber Laws: Information Security Standards, IT act 2000 Provisions, Introduction to digital laws, cyber laws, intellectual property rights, copyright laws, patent laws, software license.

References:

- Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security," Sixth Edition, Cengage Learning, 2017.
- Douglas J. Landoll, "Information Security Policies, Procedure, and Standards: A Practitioner's Reference," CRC Press, 2016.
- Harold F. Tipton, and Micki Krause, "Hand book of information security management," Sixth Edition, Archtech Publication, 2007.

- William Stallings, "Cryptography and Network Security: Principles and Practice," Sixth Edition, Pearson, 2014.

BSCS401: SOFTWARE ENGINEERING

Course Specific Outcomes:

- Understanding of Software Development Life Cycle (SDLC): Grasp the phases of SDLC, including planning, design, implementation, testing, and maintenance.
- Requirement Analysis Skills: Develop the ability to gather, document, and analyze software requirements from stakeholders effectively.
- Design and Modelling Proficiency: Use design models (such as UML diagrams) to create effective, efficient software architecture and system designs.
- Proficiency in Software Testing: Apply testing techniques to identify, troubleshoot, and fix software bugs, ensuring software quality and reliability.
- Software Maintenance and Evolution: Understand and apply strategies for software maintenance, updates, and evolving software based on user feedback and market trends.
- Team Collaboration: Enhance skills in teamwork, collaboration, and communication within a multidisciplinary team environment.

UNIT I: Introduction to Software Engineering, Definition, Characteristics of A Software, Mc Call's Quality Factors. Software Development process, SDLC, Waterfall Model, Spiral Model, prototyping approach, 4GL approach, Requirement Analysis, Definition of System Analysis, Role of system analyst, Requirement anticipation, investigation and specification, Feasibility study, Fact finding techniques-interview, questionnaire, record, review, observation.

UNIT II: Analysis and design tools, E-R analysis, Decision tree and decision tables, DFD (physical and logical), Data dictionary-definition, component, advantages Input and output design, Case studies, System design, Qualities of good design

UNIT III: System testing, Testing and debugging definition, Testing objectives and principles, Performance testing, User acceptance techniques, Stress testing, Test data generators.

UNIT IV: System maintenance, Importance of maintenance, Software maintenance, Types of maintenance, Maintenance side effects, Reverse engineering, Re-engineering, Concept of software management

References

- Software Engineering-Pressman
- Analysis and Design of Information System-James Seann
- System Analysis and Design-Parthsarthy-Khalkar
- Rajib Mall, "Fundamentals of Software Engineering"
- Pankaj Jalote, "Software Engineering", PHI.
- Mishra, Mohanti, "Software Engineering", Pearson
- Ian Sommerville, "Software Engineering", Addison Wesley

BSCS402: WEB TECHNOLOGIES

Course Specific Outcomes: On completing of this course, a student shall be:

- Understand the fundamentals of web technologies, including HTML, CSS, and JavaScript.
- Develop responsive and interactive web pages using modern front-end technologies.
- Utilize server-side programming for dynamic content generation.
- Work with databases to enable data storage and retrieval in web applications.

UNIT I: Introduction to WWW: Internet Standards, Introduction to WWW, WWW Architecture, SMTP, POP3, File Transfer Protocol, Overview of HTTP, HTTP request and response, Generation of dynamic web pages. Markup Language (HTML): Introduction to HTML and HTML , Formatting and Fonts, Commenting Code, Anchors, Backgrounds, Images, Hyperlinks, Lists, Tables, Frames, HTML Forms.

UNIT II: Cascading Style Sheet (CSS): The need for CSS, Introduction to CSS, Basic syntax and structure, Inline Styles, Embedding Style Sheets, Linking External Style Sheets, Backgrounds, manipulating text, Margins and Padding, Positioning using CSS. JavaScript Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, Advance JavaScript: JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations

UNIT III: ASP.Net, Working with ASP. Net Web Forms: Building ASP.Net Page, Building Forms with Web Server Controls, Performing Form Validation With Validation Control, Advanced Control Programming.

UNIT IV: Web Services: Introduction to Service-Oriented Architectures, XML basics, SOAP, SOAP message structure, WSDL, UDDI

References

- K.K. Sharma, "Web Technology", A.B. Publication Delhi, First Edition, 2008.
- Stephen Walther, "ASP.NET" Pearson Education, Second Edition, 2004.
- Ethan Cerami, "Web Services", O'Reilly Media, 2002.
- Achyut S Godbole and Atul Kahate, "Web Technologies", Tata McGraw Hill.
- Heith Morneau, "Active Server Pages ", Vikas Publishing House.

BSCS403: ARTIFICIAL INTELLIGENCE

Course Specific outcomes: On completing this course, the students will

- Understand foundational AI concepts, including intelligent agents, search algorithms, and problem-solving.
- Apply machine learning techniques to develop models for prediction, classification, and pattern recognition.
- analyse and solve complex real-world problems using AI algorithms and heuristics.
- Design and develop basic AI applications using programming languages and AI libraries.

UNIT I: Introduction: Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review of tree and graph structures, state space representation, search graph and search tree

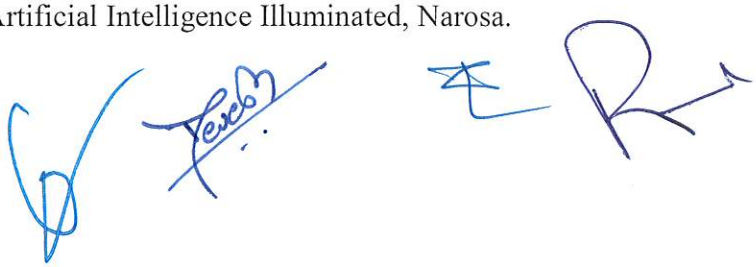
UNIT II: Search Algorithm: Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, best first search, A* algorithm, Game search.

UNIT III: Probabilistic Reasoning: Probability, conditional probability, Bayes Rule, Bayesian Network representation, Construction and inference, temporal model, Hidden Markov model. Markov Decision: MDP formulation, Utility theory, Utility functions, value iteration, policy iteration and partially observable MDPs.

UNIT IV: Reinforcement Learning: Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning -Q learning.

References

- Shing Roger Jang, Chuen: Tsai Sun, EijiMizutani, Neuro: Fuzzy and Soft Computing, PHU
- George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic: Theory and Application, PHI
- George F Luger, Artificial intelligence, Structure and strategies for Complex Problem Solving, Addison- Wesley
- Ben Coppier, Artificial Intelligence Illuminated, Narosa.



BSCS408: MACHINE LEARNING

Course Specific Outcomes: After successful completion of this course, student will

- Data Preparation: Apply data preprocessing and feature engineering techniques.
- Algorithm Application: Select and implement appropriate machine learning algorithms.
- Model Evaluation: Train, evaluate, and improve model performance using key metrics.
- Real-World Problem Solving: Utilize machine learning for practical applications across industries.
- Ethics and Bias Awareness: Recognize and address ethical issues and biases in machine learning models.

UNIT I: Introduction- overview of machine learning- Different forms of learning- Generative 6 learning- Gaussian parameter estimation- maximum likelihood estimation- MAP estimation- Bayesian estimation- bias and variance of estimators- missing and noisy features- nonparametric density estimation- applications- software tools.

UNIT II: Classification Methods-Nearest neighbour- Decision trees- Linear Discriminant Analysis - Logistic regression-Perceptron's- large margin classification- Kernel methods- Support Vector Machines. Classification and Regression Trees.

UNIT III: Graphical and sequential models- Bayesian networks- conditional independence Markov random fields- inference in graphical models- Belief propagation- Markov models- Hidden Markov models- decoding states from observations- learning HMM parameters

UNIT IV: Clustering Methods-Partitioned based Clustering - K-means- K-medoids; Hierarchical Clustering - Agglomerative- Divisive- Distance measures; Density based Clustering - DBScan; Spectral clustering.

References

- T. Hastie, R. Tibshirani and J. Friedman, "Elements of Statistical Learning", Springer, 2009.
- E. Alpaydin, "Machine Learning", MIT Press, 2010.
- K. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
- C. Bishop, "Pattern Recognition and Machine Learning, Springer", 2006.
- Shai Shalev-Shwa rtz, Shai Ben-David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014.

- John Mueller and Luca Massaron, "Machine Learning For Dummies", John Wiley & Sons, 2016.