Annexure 15.1

Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University under Category „A" by MHRD, Estd. u/s 3 of UGC Act 1956)
Re-accredited with „A++" Grade by NAAC. Recognized by UGC Under Section 12 B
Coimbatore-6410043, Tamilnadu, India

Department of Computer Science

B.Sc. Computer Science

Programme Outcomes

PO1. Demonstrate the aptitude of Computer Programming and Computer based problem solving skills.

PO2. Display the knowledge of appropriate theory, practices and tools for the specification, design, implementation.

PO3. Ability to learn and acquire knowledge through online courses available at different MOOC Providers.

PO4. Ability to link knowledge of Computer Science with other related domain.

PO5. Display ethical code of conduct in usage of Internet and Cyber systems.

PO6. Ability to pursue higher studies of specialization and to take up technical employment.

PO7. Ability to formulate, to model, to design solutions, procedure and to use software tools to solve real world problems and evaluate.

PO8. Ability to operate, manage, deploy, configure computer network, hardware, software operation of an organization.

PO9. Ability to present result using different presentation tools.

PO10. Ability to appreciate emerging technologies and tools.

Programme Specific Outcomes

PSO1: Create adequate knowledge base in core areas of computer science and apply skill sets in programming.

PSO2: Awareness about future technological advancements in experiencing computer science domains and participation in societal responsibilities.

PSO3: Competent for higher studies in computer related fields and readiness for employability.

Scheme of Instruction & Examinations
(for students admitted from 2023-2024 & onwards)

Part	Subject Code	Name of paper / Component	Hours of instruction / week	Scheme Examination				
				Duration of exam	CIA	CE	Total	Credit
		First Semester						
I	23BLT001/ 23BLH001/ 23BLF001	பொதுத்தமிழ்தாள் I - இக்காலஇலக்கியம்/ Prose and NonDetailed Texts / French I	2	3	50	50	100	2
II	23BAEEC1	**Ability Enhancement Compulsory Course - I** English for Communication	4	3	50	50	100	4
	Generic Elective							
		Generic Elective - I	5+1/4+4	3	50	50	100	6
III	**Discipline Specific Core Courses**							
	23BCSC01	Programming Methodology	4	3	50	50	100	4 6
	23BCSC01P	Programming Methodology Laboratory	4	3	50	50	100	2
	23BCSC02	Computer System Architecture	5+1	3	50	50	100	6
IV	**Skill Enhancement Courses**							
	23BVBNC1/ 23BVBNS1/ 23BVBSP1	**Value Based course Elective I NCC/NSS/Sports**	3/2	2	60	40	100	4/1/1
	Professional Development Course							
	23BCSPD1	Computer Ethics	3	-	100	-	100	Remarks
		Games - Practical	1					
		Total	**30**				**Total**	**28/25**
		Second Semester						
I	23BLT002/ 23BLH002/ 23BLF002	பொதுத்தமிழ்தாள் II அறஇலக்கியம்/ Grammar,Translation and General Essay /French II	2	3	50	50	100	2
II	23BAEES1	**Ability Enhancement CompulsoryCourse - II** Environmental Studies	4	3	50	50	100	4
	Generic Electives (GE-II)							
	23BENGE2A/ 23BENGE2B/ 23BENGE2C/ 23BENGE2D	**Introduction to Literature / British Literature / Modern Indian Literature / New Literatures in English**	5+1	3	50	50	100	6

Part	Subject Code	Name of paper / Component	Hours of instruction /week	Scheme Examination					
				Duration of exam	CIA	CE	Total	Credit	
III	**Discipline Specific Core Courses**								
	23BCSC03	Data Structures	4	3	50	50	100	4	6
	23BCSC03P	Data Structures Laboratory	4	3	50	50	100	2	
	23BCSC04	Discrete Structures	5+1	3	50	50	100	6	
IV	**Skill Enhancement Courses**								
	23BVBNC2/ 23BVBNS2/ 23BVBSP2	**Value Based Courses Elective I NCC/NSS/Sports**	3/2	2	60	40	100	4/1/1	
	Professional Development Course								
	23BCSPD2	Quantitative Aptitude and Reasoning	3	-	100	-	100	Remarks	
		Games – Practical	1		-	-	-		
		Total	**30**				**Total**	**28/25**	
Internship during Summer Vacation for 15 days									
		Third Semester							
I	23BLT003/ 23BLH003/ 23BLF003	பொதுத்தமிழ்தாள் III சமயஇலக்கியம்/ Ancient and Modern Poetry/ French III	2	3	50	50	100	2	
II	**Generic Elective**								
		Generic Elective - III	5+1/4+4	3	50	50	100	6	
III	**Discipline Specific Core Courses**								
	23BCSC05	Operating Systems	5+1	3	50	50	100	6	
	23BCSC06	Algorithms	4	3	50	50	100	4	6
	23BCSC06P	Algorithms Laboratory	4	3	50	50	100	2	
IV	**Skill Enhancement Courses**								
	23BSBCS1	**Skill Based Compulsory Course-I** Communication Skill	4P	3	50	50	100	2	
		Skill Based Elective Course-II	4P	3	50	50	100	2	
	23BVBNC3/ 23BVBNS3/ 23BVBSP3	**Value Based course Elective I NCC/NSS/Sports**	3/2	2	60	40	100	4/1/1	
		Value Based course Elective II	2	-	100	-	100	2	
		Total	**32**				**Total**	**30/27**	
		Fourth Semester							
I	23BLT004/ 23BLH004/ 23BLF004	பொதுத்தமிழ்தாள் IV - சங்கஇலக்கியம்/Introduction to Functional Hindi/French IV	2	3	50	50	100	2	
II	**Generic Elective**								
		Generic Elective - IV	5+1/4+4	3	50	50	100	6	

Part	Subject Code	Name of paper / Component	Hours of instruction / week	Scheme Examination				
				Duration of exam	CIA	CE	Total	Credit
III	**Discipline Specific Core Courses**							
	23BCSC07	Computer Networks	5+1	3	50	50	100	6
	23BCSC08	Software Engineering	5+1	3	50	50	100	6
IV	**Skill Enhancement Courses**							
	23BSBSS1	**Skill Based Compulsory Course-III** Soft Skill	4P	3	50	50	100	2
		Skill Based Elective Course-IV	4P	3	50	50	100	2
	23BVBNC4/ 23BVBNS4/ 23BVBSP4	**Value Based course Elective I NCC/NSS/Sports**	3/2	2	60	40	100	4/1/1
		Value Based course Elective III	2	-	100	-	100	2
		Total	**30**				**Total**	**30/27**
	Internship during Summer Vacation for 15 days							
	Fifth Semester							
III	**Discipline Specific Core Courses**							
	23BCSC09	Database Management Systems	4	3	50	50	100	4
	23BCSC09P	Relational Database Management Systems Laboratory	4	3	50	50	100	2 — 6
	23BCSC10	Internet Technologies	5+1	3	50	50	100	6
	23BCSDE1-23BCSDE6	**Discipline Specific Elective Course -DSE – I**						
		Theory + Practical / Theory + Tutorial	5+1/ 4/4	3	50	50	100	6
	23BCSDE1 - 23BCSDE6	**Discipline Specific Elective Course -DSE – II**						
		Theory + Practical / Theory + Tutorial	5+1 / 4+4	3	50	50	100	6
IV	**Skill Enhancement Courses**							
	23BVBNC5/ 23BVBNS5/ 23BVBSP5	**Value Based courses Elective I NCC/NSS/Sports**	3/2	2	60	40	100	4/1/1
	Professional Development Course							
	23BCSPD3	Technical Communication	2	-	100	-	100	Remarks
			30				**Total**	**28/25**
		Sixth Semester						
III	**Discipline Specific Core Courses**							
	23BCSC11	Artificial Intelligence	5+1	3	50	50	100	6
	23BCSC12	Computer Graphics	4	3	50	50	100	4 — 6
	23BCSC12P	Computer Graphics Laboratory	4	3	50	50	100	2
	23BCSDE1-23BCSDE6	**Discipline Specific Elective Course -DSE – III**						
		Theory + Practical / Theory + Tutorial	5/1 / 4+4	3	50	50	100	6

	23BCSDE7	**DSE – IV** Project and Internship	4+4	3	50	50	100	6
IV	**Skill Enhancement Courses**							
	23BVBNC6/ 23BVBNS6/ 23BVBSP6	**Value Based courses Elective I** **NCC/NSS/Sports**	3/2	2	60	40	100	4/1/1
	Professional Development Course							
	23BCSPD4	Professional IT Skills	2	-	100	-	100	Remarks
			30				**Total**	**28/25**
	Over all total							**172/154**

- **Ability Enhancement Compulsory Courses**
- English for Communication
- Environmental Studies

- **Skill Enhancement courses**, are Skill Based and / or Value Based which are aimed at providing hands on training, competencies, skills etc. and may be opted by the students from the electives offered by the departments or from SWAYAM MOOCs / NPTEL

Skill Based courses

- **Skill Based Compulsory courses I – 23BSBCS1 – Communication Skill** during 3rd semester
- **Skill Based Compulsory courses III - 23BSBSS1 – Soft Skill** during 4th semester

- **Skill Based Elective courses** offered by Computer Science department

S.No	Skill Based Elective Courses (II / IV)	Semester	Hours of instruction/week Practical	Credits
1	**23BCSSE1 – Python Programming Laboratory**	3	4P	2
2	**23BCSSE2 – Java Programming Laboratory**		4P	
3	**23BCSSE3 – C++ Programming Laboratory**		4P	
4	**23BCSSE4 – R Programming Laboratory**	4	4P	
5	**23BCSSE5– Web Programming Laboratory**		4P	
6	**23BCSSE6– Android Programming Laboratory**		4P	

- **Value Based Courses - Elective I**

Value Based Courses Elective I	Subject Code	Semester	No of .Credits
NCC/	**23BVBNC1-6/**	**1-6**	24 Credits
NSS/	**23BVBNS1-6/**		6 Credits
Sports	**23BVBSP1-6**		6 Credits

* **Discipline Specific Elective Courses** should be related to their own core which may be from SWAYAM MOOCs / NPTEL also
  - All the courses have 6 credits with 4 hours of theory and 4 hours of practicals or 5 hours of theory and 1 hour of Tutorials.

S.No	Discipline Specific Elective Courses	Semester	Hours of instruction/ week	Credits
			Theory + Practical /Theory + Tutorial	
1.	23BCSDE1 - Image Processing	5 & 6	5+1	6
2.	23BCSDE2 - Fundamentals of Data Science		4+4	
3.	23BCSDE3 - Cyber Security		4+4	
4.	23BCSDE4 - Cloud Computing		5+1	
5.	23BCSDE5 –Internet of Things		5+1	
6.	23BCSDE6 – Machine Learning		5+1	
7.	23BCSDE7 – Project and Internship		4+4	

- **Generic Elective Courses** offered for other disciplines / departments
  - A Core Course offered in a Discipline / Subject may be offered as a Generic Elective for other departments.

S.No	Generic Elective Courses	Semester	Hours of instruction/week	Credits
			Theory + Practical /Theory + Tutorial	
1	23BCSGE1 - Computer Fundamentals and Office Automation	1	5+ 1	6
2	23BCSGE2 - Internet Basics		5+1	
3	23BCSGE3- GIMP- Image Editing Tool	3	4+4	
4	23BCSGE4 - Desktop Publishing		4+4	
5	23BCSGE5 – Introduction to Internet of Things	4	5+1	
6	23BCSGE6 Digital Marketing		5+1	

Total credits to earn the degree

1. Part I components - 8 Credits (Languages)
2. Part II components – 32 Credits [Ability Enhancement Courses – 8 Credits and Generic Elective Courses – 24 Credits]
3. Part III components - 96 Credits (Discipline Specific Core Courses – 72 Credits and Discipline Specific Elective Courses - 24 Credits)
4. Part IV components - 36/18 (Skill Enhancement Courses – Skill Based Courses – 8 credits, Value Based Courses Elective I (NCC/NSS/Sports) –24 / 6 / 6, Value Based Elective Courses Elective II & III – 4 credits)
5. **Minimum One Course should be from SWAYAM MOOCs/ NPTEL.**

One to 4 Courses may be from SWAYAM MOOCs/NPTEL for Credit Transfer in DSE/ Generic Elective.

Programming Methodology

Semester I **Hours of Instruction / Week: 4**

23BCSC01 **No. of Credits: 4**

Objectives:

1. To understand the design of algorithms and method of programming.
2. To make the student understand the Fundamental programming concepts and Methodologies
3. To develop skills in writing programs for different applications and can easily switch over to any other language in future.

UNIT I **12 hrs**

Introduction to Programming -Program Concept, Characteristics of Programming, Stages in Program Development, Algorithms, Notations, Design, Flowcharts, Types of Programming Methodologies, Introduction to C Programming - Basic Program Structure in C, Variables and Assignments, Input and Output, Selection and Repetition

UNIT II **12 hrs**

Top-Down Design, Predefined Functions, Programmer -defined Function, Local Variable, Function Overloading, Functions with Default Arguments, Call-By-Value and Call-By-Reference Parameters, Recursion

UNIT III **12 hrs**

Introduction to Arrays, Declaration and Referring Arrays, Arrays in Memory, Initializing Arrays. Arrays in Functions, Multi-Dimensional Arrays, Structures - Member Accessing, Pointers to Structures, Structures, and Functions.

UNIT IV **12 hrs**

Arrays of Structures, Unions, Declaration, and Initialization, Reading and Writing Strings, Arrays of Strings, String and Function, Strings and Structure, Standard String Library Functions.

UNIT V **12 hrs**

Searching Algorithms - Linear Search, Binary Search. Use of files for data input and output. Merging and copying files.

Total Hours: 60 hrs

Text Books:

1. ***Behrouz A. Forouzan, (2017),Foundations of computer science***, Thomson Course Technology, Fourth Edition.
2. ***E.Balagurusamy (2011), Programming in ANSI C,*** Tata McGraw Hill Publishing Company Ltd., Fifth Edition.
3. ***R. Hanly and E. B. Koffman (2015), Problem Solving and Program Design in C*** Pearson, Seventh Edition,

Reference Books:

1. ***YashwantP.Kanetkar, (2010), Let us C,*** BPB Publications, Sixth Edition.
2. ***Rajaraman V, (2015), Fundamental of Computers***, Prentice Hall of India, New Delhi, 6th edition.
3. ***Binu.A (2010), Problem Solving and Computer Programming Using C***, University Science Press, Laxmi Publications.
4. ***Horowitz Ellis SahniSartaj& Anderson- Susan*(2008), *Fundamentals Of Data Structures In C(Pul)***, 2, Reprint, Orient BlackSwan.

E-learning Resource:

1. www.tutorialspoint.com/cprogramming/cprogramming_tutorial.pdf

Course Outcomes:

CO1: Obtain knowledge to design algorithms and draw flowcharts to solve a problem.

CO2: Develop problem solving skills coupled with top-down design principles.

CO3: Acquire knowledge to implement different Operations on arrays.

CO4: Trained skill to solve problems through programming for simple applications.

CO5: Understand the use of Arrays, functions, pointers, structures and unions.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	L	M	-	-	-	H	H	-	-	L	H	-	-
CO2	M	M	-	M	-	M	M	L	-	-	H	L	L
CO3	M	-	-	-	-	H	H	M	M	-	H	H	M
CO4	-	-	M	M	-	M	M	-	-	-	H	H	L
CO5	-	-	L	-	-	M	H	L	-	-	H	H	L

Programming Methodology Laboratory

Semester I **Hours of Instruction / Week: 4**

23BCSC01P **No. of Credits: 2**

List of Programs:

1. Programs using conditional control structures.
2. Programs using Iterative Control Statements.
3. Programs using Arrays.
4. Programs to use functions and parameter passing in function.
5. Programs using recursive functions.
6. Programs using string handling functions.
7. Programs using Structures and Union.
8. Programs using pointers.
9. Programs using files for data input and output.
10. Programs to implement search algorithms.

Course Outcomes:

CO1: Design and develop programs that demonstrate effective use of programming

CO2: Trace and execute the programs written in language.

CO3: Develop programs using the basic elements like decision and control statements,

CO4: Develop programs using Arrays and Strings, User defined functions and pointers

CO5: Apply programming constructs to develop simple applications using files.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	M	M	-	M	M	M	M	L	H	M	L
CO2	H	H	M	M	-	M	M	M	M	-	H	M	L
CO3	H	H	M	-	-	L	L	L	M	-	H	L	-
CO4	H	H	M	-	-	L	L	L	M	-	H	L	-
CO5	H	H	M	-	-	L	L	L	M	-	H	L	-

Computer System Architecture

Semester I **Hours of Instruction / Week: 5+1**

23BCSC02 **No. of Credits: 6**

Objectives:

1. To make students understand the basic structure, operation and characteristics of digital computer.
2. To familiarize the students with processor instruction handling with parallelism and control implementation
3. To familiarize the students with hierarchical memory system and Input-output transfer schemes

UNIT I: Fundamentals of Digital Electronics **18 hrs**

Data Types, Complements, Fixed-Point Representation, Floating-Point Representation, Other Binary Codes, Error Detection Codes, Logic Gates, Boolean Algebra, Map Simplification, Combinational Circuits, Flip-Flops, Sequential Circuits, Registers, Counters, Multiplexer, Demultiplexer, Decoder, Encoder.

UNIT II: Register Transfer and Micro-operations **18 hrs**

Register Transfer Language, Register Transfer, Bus & Memory Transfer, Arithmetic Micro operations, Logic Micro operations, Shift Micro operation.

UNIT III: Basic Computer Organization **18 hrs**

Instruction codes, Computer Registers, Computer Instructions, Timing & Control, Instruction Cycles, Memory Reference Instruction, Input -Output & Interrupts, Complete Computer Description & Design of Basic Computer.

UNIT IV: Processor and Control Unit **18 hrs**

Hardwired vs. Micro programmed Control Unit, General Register Organization, Stack Organization, Instruction Format, Data Transfer & Manipulation, Program Control, RISC, CISC, Pipelining – Pipelined data path and control – Handling Data hazards & Control hazards.

UNIT V: Memory and I/O Systems **18 hrs**

Peripheral Devices, I/O Interface, Data Transfer Schemes, Program Control, Interrupt, DMA Transfer, I/O Processor. Memory Hierarchy, Processor vs. Memory Speed, High-Speed Memories,Cache Memory, Associative Memory, Interleave, Virtual Memory- Instruction-level-parallelism

Total Hours: 90

Text Books

1. **M.Morris Mano (2014)**, Computer System Architecture, Prentice Hall, Third Edition,
2. **DavidA. Patterson and John L.Hennessey (2014)**, Computer Organizationand Design, Morgan Kauffman, Elsevier, Fifth Edition.

Reference Books

1. **John L. Hennessy, DavidA. Patterson (2012)**, Computer Architecture: A Quantitative Approach, Fifth Edition.
2. **William Stallings (2016)**, Computer Organization and Architecture, Prentice Hall.Tenth Edition

Course Outcomes:

CO1: Apply Boolean Logic in circuit design with gates and other digital hardwares

CO2: Distinguish the application of various micro operations in Register Transfer Language.

CO3: Handle the various parameters related to instruction execution.

CO4: Understand the control unit implementation and CPU instruction handling.

CO5: Appraise the various information storage - retrieval concepts and I/O transfer methods

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	L	H	H	M	-	L	M	H	H	M	M	L	H
CO2	L	M	M	L	-	L	L	-	M	M	M	L	L
CO3	M	-	M	L	-	L	L	M	M	M	M	L	M
CO4	L	-	M	-	-	L	L	-	L	M	L	L	L
CO5	-	-	M	-	-	M	-	-	L	M	M	L	L

Professional Development Course

Computer Ethics

Semester I **Hours of Instruction / Week: 3 Hrs**

23BCSPD1

Objectives:

1. To be familiar with ethical theories.
2. To have knowledge for solving ethical problems.
3. To apply ethical principles to situations and dialectical thinking.

UNIT I **9 hrs**

The Need for Computer Ethics, Defining the field of Computer Ethics, Computer Ethics codes, Computer Crime and Computer Security, Software theft and intellectual property rights, Computer hacking and the creation of viruses.

UNIT II **9 hrs**

Computer and Information system failure, Invasion of privacy. Privacy in the Workplace and on the Internet, Social implications of artificial intelligence and expert systems ,The information technology salesman issues

UNIT III **9 hrs**

Transparency and Virtual Ethics, Free Speech, Democracy, Information Access

UNIT VI **9 hrs**

Developing the Ethical Analysis Skills and Professional Values, Privacy, Accountability, Government Surveillance

UNIT V **9 hrs**

Boundaries of Trust, Trust Management, Wikipedia, Virtual Trust, Plagiarism in Online Environment, Intellectual Property, Net neutrality

Total Hours 45 hrs

Text Books:

1. Deborah, J, Nissenbaun, H, Computing, Ethics & Social Values, Englewwod Cliffs, New Jersey,Prentice Hall, 1995.

2.Spinello, R, Tavani, H, T, Readings in Cyberethics, Sudbury, MA, Jones and Bartlett Publishers,2001.

Reference Books:

1. Bynum, T, W; Rogerson, S, Computer Ethics and Professional Responsibility, Blackwell, 2004.

Course Outcomes:

CO1: Apply Security & Privacy techniques in real time applications.

CO2: To Know the Privacy and its Social Implications.

CO3: Ability to choose information based on access rights.

CO4: Developing ethical analytical skills.

CO5: To know about Plagiarism, trust & intellectual property.

Data Structures

Semester II **Hours of Instruction / Week: 4**

23BCSC03 **No. of Credits: 4**

Objectives:

1. To become familiar with fundamental data structures of linear and non-linear forms.
2. To gain knowledge on operations and implementations of these data structures.
3. To comprehend and use appropriate data structures relevant to the problem

Unit I: Introduction **12 hrs**

Overview of Algorithms –Algorithm Specification, Data Abstraction, Performance Analysis, Linear Data Structures and Non Linear Structures- Arrays- representation of arrays and operations.

Unit II: Stack and Queue **12 hrs**

Stacks –Operations, Array and Linked Implementations, Applications- infix to postfix conversion, postfix expression evaluation, Queue-Operations, Array and Linked Implementations, Circular Queue, Dequeue, Linked list-Singly, Doubly, Circularly Linked List-Operations.

Unit III: Trees and Graphs **12 hrs**

Trees - Basic Concepts, Representation of Trees, Binary Tree, Properties of Binary tree representation- Array and Linked List Representation, Binary tree traversals, Threaded binary trees representation, traversal, Graphs-basic concepts, representation, search techniques,

Unit IV: File structures and Hashing **12 hrs**

Sequential, Indexed sequential and Direct files ,Hashing-Introduction, Hash Tables, Hash functions, Overflow Handling.

Unit V: Advanced concepts in Data structures **12 hrs**

Indexing, Balanced search trees, B trees,B+ trees, Heaps

Total Hours: 60

Text Books:

1. Sahni Horowitz, Anderson Freed (2017), Fundamentals of Data Structure in C, University Press, Second Edition.

2.Lipschutz, Pai (2014), Schaum's Outline Series Data Structures with C, Tata Mcgraw Hill.

Reference Books:

1. M.A.Weiss,(2010),Data Structures and Algorithm Analysis in C,Pearson.

2. Jean Paul Tremblay and Paul Anderson, (2005), An Introduction to Data Structures with Applications, McGraw Hill, Second Edition.

E-learning Resources:

1. https://nptel.ac.in/courses/106102064
2. https://www.w3schools.in/data-structures/intro
3. https://www.programiz.com/dsa

Course Outcomes:

CO1: To understand the basics of algorithms and data structures.

CO2: Apply linear and nonlinear data structures to programming solutions

CO3: Understand and apply tree and graph structures.

CO4: Ability to choose and implement appropriate data stuctures in real-time problems.

CO5: Obtain knowledge of advanced data structures.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	M	H	H	-	M	L	L	L	L	H	M	L
CO2	M	H	H	H	-	M	H	M	M	M	H	M	L
CO3	M	H	H	H	-	M	H	M	M	M	H	M	L
CO4	M	H	H	H	-	M	H	M	M	M	H	M	L
CO5	M	M	H	H	-	M	M	M	M	M	M	L	L

Data Structures Laboratory

Semester II **Hours of Instruction / Week: 4**

23BCSC03P **No. of Credits: 2**

List of Programs:

1. Programs using Arrays.
2. Programs using Stack.
3. Programs using Queue.
4. Programs using Linked List.
5. Programs using Tree.
6. Programs using Graph.
7. Programs to implement Hashing function.
8. Programs to implement Sorting algorithms.
9. Programs to implement Searching algorithms.
10. Programs using advanced data structures.

Course Outcomes:

CO1: Design and develop programs that demonstrate effective use of data structures.

CO2: Implement the operations of linear data structures and non-linear data structures.

CO3: Understand and apply suitable data structures to solve real-life problems.

CO4: Develop programs that demonstrate the use of sorting and searching methods.

CO5: Gain knowledge on data organization using advanced data structures.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	M	H	H	-	M	L	L	L	L	H	M	L
CO2	M	H	H	H	-	M	H	M	M	M	H	M	L
CO3	M	H	H	H	-	M	H	M	M	M	H	M	L
CO4	M	H	H	H	-	M	H	M	M	M	H	M	L
CO5	M	M	H	H	-	M	M	M	M	M	M	L	L

Discrete Structures

Semester II **Hours of Instruction / week : 5 + 1**

23BCSC04 **No. of credits: 6**

Objectives:

1. To introduce a variety of topics in Discrete Mathematics and their applications tocomputer science.
2. To develop Knowledge related to mathematical reasoning.
3. To write a clear statement of a problem as a theorem in mathematical notation.

Unit I: Sets **18 hrs**

Finite and Infinite Sets, Uncountable Infinite Sets; Functions, Relations, Properties of Binary Relations, Closure, Partial Ordering Relations; Counting - Pigeonhole Principle, Permutation and Combination; Mathematical Induction, Principle of Inclusion and Exclusion.

Unit II: Growth of Functions **18 hrs**

Asymptotic Notations, Summation Formulas and Properties, Bounding Summations, Approximation by Integrals.

Unit III: Recurrences **18 hrs**

Recurrence Relations, Generating Functions, Linear Recurrence Relations with Constant Coefficients and their Solution, Substitution Method, Recurrence Trees,Master Theorem

Unit IV: Graph Theory **18 hrs**

Basic Terminology, Models and Types, Multigraphs and Weighted Graphs, Graph Representation, Graph Isomorphism, Connectivity, Euler and Hamiltonian Paths and Circuits, Planar Graphs, Graph Coloring

Unit V: Trees & Propositional Logic **18 hrs**

Trees, Basic Terminology and Properties of Trees, Introduction to Spanning Trees. Logical Connectives, Well-formed Formulas, Tautologies, Equivalences, Inference Theory

Total Hours: 90

Text Books:

1. ***Trembly and Manohar (2008). Discrete Mathematical Structures with Applications to Computer Science***, Fifth reprint, Tata McGraw Hill Publications.
2. ***C.L. Liu & Mahopatra (1985). Elements of Discrete mathematics***, 2nd Sub Edition, Tata McGraw Hill
3. ***Rosen (2006). Discrete Mathematics and Its Applications***, Sixth Edition.
4. ***T.H. Coremen, C.E. Leiserson, R. L. Rivest, (2009). Introduction to algorithms***, Prentice Hall on India (3rd edition)

Reference Books:

1. ***Kenneth H. Rosen (2012).Discrete Mathematics and its Applications,*** Seventh Edition, Tata McGraw Hill Publications.
2. ***Bernard Kolman, Robert C.Busby, Sharon Cutler Ross (2009). Discrete Mathematical Structures***, Sixth Edition, Pearson Education.
3. ***M. O. Albertson and J. P. Hutchinson (1988), Discrete Mathematics with Algorithms*** John wiley Publication.

Course Outcomes:

CO1: Understand the notion of mathematical thinking, mathematical proofs, and algorithmicthinking, and be able to apply them in problem solving.

CO2: Understand the basics of combinatorics, and be able to apply the methods from these subjectsin problem solving.

CO3: Be able to use effectively algebraic techniques to analyse basic discrete structures andalgorithms.

CO4: Understand asymptotic notation, its significance, and be able to use it to analyse asymptoticperformance for some basic algorithmic examples.

CO5: Understand some basic properties of graphs and trees and related discrete structures, and be able torelate these to practical examples.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	H	M	L	-	M	L	-	M	L	M	L	M
CO2	M	H	M	L	-	M	L	-	M	L	M	L	M
CO3	M	H	M	L	-	M	L	-	M	L	M	L	M
CO4	M	H	M	L	-	M	L	-	M	L	M	L	M
CO5	M	H	M	L	-	M	L	-	M	L	M	L	M

Professional Development Course

Quantitative Aptitude and Reasoning

Semester II **Hours of Instruction / Week: 3 Hrs**

23BCSPD2

Objectives:

1. To understand various principles involved in solving mathematical problems.
2. To understand the abstract principle that works beneath the findings.
3. To evaluate various real life situations by resorting to analysis of key issues and actors.

Unit I: Numerical Aptitude on Ages, Profit and Ratio **9 hrs**

Simple Equations, Numbers, Average, Problems on Ages, Percentage, Profit & Loss, Ratio & Proportions.

Unit II: Numerical Aptitude on Time, Work, Interest Rates **9 hrs**

Time & Work, Time & Distance, Problems on Trains, Simple Interest, Compound Interest, Calendar & Clocks, Permutations & Combinations.

Unit III: Data Interpretation and Data Sufficiency **9 hrs**

Tabulation, Graphs Bar Graphs, Pie Graphs, Line Graphs, Venn Diagrams, Cubes, Deductions,Connectives, Data Sufficiency Concepts.

Unit IV: Verbal & Logical Reasoning **9 hrs**

Verbal- Reading Comprehension, Text Completion, Sentence Equivalance, Synonyms & Antonyms.Logical–Statement-Arguments,Statement-Assumptions, Statement-Conclusions.

Unit V: Non–Verbal Reasoning **9 hrs**

Coding & Decoding, Blood Relations, Analytical Reasoning Puzzles, Direction Sense Test, Decision Making, Assertion & Reasons, Completion of Patterns.

Total Hours:45

TextBooks:

1. ***Dr.R.S.Agarwal,(2017),Quantitative Aptitude*** ,S.Chand Publishing.
2. ***Dr. R. S. Agarwal,(2017), A Modern Approach to Verbal & Non-Verbal Reasoning,*** S. Chand Publishing.

Reference Books:

1. ***Dr.R.S.Agarwal ,(2017), A Modern Approach to Logical Reasoning***, S.Chand Publishing.

2. ***Abhijit Guha, (2016), Quantitaive Aptitude,*** TataMcGraw Hills Publishing, Sixth Edition

E-learning Resources:

1. https://www.talentsprint.com/blog/2016/04/18-websites- for-competitive-exams-you.html
2. .https://www.tutorialspoint.com/quantitative_aptitude/index.htm

Course Outcomes:

CO1: Acquires Time Management for Competitive Examinations.

CO2: Makes Calculation successfully, Interprets Data, Communicate Results, Evaluates an issue and solve a problem in real-world context.

CO3: Develops Critical Thinking by analyzing complex issues using information from credible sources.

CO4: Procures the ability to read between the lines and understand various language structures.

CO5: Comprehends quick decision making.

Operating Systems

Semester III **Hours of Instruction/ Week: 5+1**

23BCSC05 **No. of Credits: 6**

Objectives:

1. To understand the concept of process, resources, scheduling, and thread management
2. To understand the concepts of process synchronization and deadlock
3. To be aware of the latest trends in Operating Systems in Android Applications

UNIT I: Introduction to Operating System **18 hrs**

Define Operating System. History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems; Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems.

UNIT II: Operating System Organization and Process Characterization **18 hrs**

Processor and User Modes, Kernels, System Calls and System Programs, System View of the Process and Resources, Process Abstraction, Process Hierarchy, Threads, Threading Issues, Thread Libraries; Process Scheduling, Non-Pre-emptive and Pre- emptive Scheduling Algorithms-

UNIT III: Process Management Deadlock **18 hrs**

Deadlock, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock, Deadlock Handling Approaches: Deadlock Prevention, Deadlock Avoidance and Deadlock Detection and Recovery- (Inter Process Communication and Synchronization) Concurrent and Dependent Processes, Critical Section, Semaphores, Methods for Inter-process Communication; Process Synchronization, Classical Process Synchronization Problems: Producer-Consumer, Reader-Writer

UNIT IV: Memory Management **18 hrs**

Physical and Virtual Address Space; Memory Allocation Strategies– Fixed and -Variable Partitions, Paging, Segmentation, Virtual Memory.- (File and I/O Management, OS security) Directory Structure, File Operations, File Allocation Methods, Device Management, Pipes, Buffer, Shared Memory, Security Policy Mechanism, Protection, Authentication and Internal Access Authorization

UNIT V: Introduction to Android Operating System **18 hrs**

Introduction to Android Operating System, Android Development Framework, Android Application Architecture, Android Process Management and File System, Small Application Development using Android Development Framework.

Total Hours 90 hrs

Text Books:

1. ***Harvey M.Deital, Paul. J.Deitel, David R.Choffnes, (2004), "Operating Systems"***, *Third Edition, Pearson Publications.*

Reference Books:

1. A Silberschatz, P.B. Galvin, G. Gagne, Operating Systems Concepts, 9th Edition, John Wiley Publications 2013.
2. A.S. Tanenbaum, Modern Operating Systems, 3rd Edition, Pearson Education 2008.
3. G. Nutt, Operating Systems: A Modern Perspective, 2nd Edition Pearson Education,2004.
4. W. Stallings, Operating Systems, Internals & Design Principles 2008 5th Edition,Prentice Hall of India.
5. M. Milenkovic, Operating Systems- Concepts and Design, Tata McGraw Hill 1992.

E-learning Resources:

1. nptel.ac.in/courses/106108101
2. w3schools.in/operating-system-tutorial

Course Outcomes:

CO1: Obtain knowledge to know about the types of algorithms.

CO2: Understand the concepts of Kernels and threading concepts.

CO3: Learning about Deadlocks and their types.

CO4: Develop skills on Memory Management.

CO5: Trained skills in Android Applications.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	L	M	M	H	L	-	M	-	L	L	M	M	-
CO2	L	M	M	H	L	-	M	-	L	L	M	M	-
CO3	L	M	M	H	L	-	M	-	L	L	M	M	-
CO4	L	M	M	H	L	-	M	-	L	L	M	M	-
CO5	L	M	M	H	L	-	M	-	L	L	M	M	-

Algorithms

Semester III **Hours of Instruction / Week: 4**

23BCSC06 **No. of Credits: 4**

Objectives

1. To learn good principles of algorithm design;

2. To learn how to analyse algorithms and estimate their worst-case and average-case behaviour 3. To become familiar with fundamental data structures and with the manner in which these data structures can best be implemented; become accustomed to the description of algorithms in both functional and procedural styles

4. To learn how to apply their theoretical knowledge in practice (via the practical component of the course).

UNIT I: Introduction **12 hrs**

Basic Design and Analysis Techniques of Algorithms, Correctness of Algorithm. Algorithm Design Techniques: Iterative Techniques, Divide and Conquer, Dynamic Programming, Greedy Algorithms.

UNIT II: Sorting and Searching Techniques **12 hrs**

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, Searching Techniques-Sequential search and Binary search

UNIT III: Graphs Algorithms **12 hrs**

Graph Algorithms– Breadth First Search, Depth First Search and its Applications, Minimum Spanning Trees. String Processing

UNIT IV: Complexity analysis **12 hrs**

Lower,upper and tight bounds,Asymptotic notations, NP hard and NP complete classes.

UNIT V: Advanced Analysis Technique **12 hrs**

Randomized Algorithm, Distributed Algorithm, Heuristic search techniques

Total Hours 60 hrs

Text Books

1. ***T.H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein , Introduction to Algorithms***, MIT Press, 4th Edition 2022

2. ***Sara baase , Allen Van Gelder, Computer Algorithm – Introduction to Design and Analysis,*** Pearson, 3rd Edition 1999

Reference Books:

1. ***Brassard, Paul Bradely, (2009), " Fundamentals of algorithms"***, Eastern economy Edition
2. ***Sartaj Sahni, (2009) ," Data Structures, Algoritjms and Applications in C++",*** university Press.
3. ***Weiss, Mark Allen (2009), "Data Structures and Algorithm Analysis in C",*** Second edition , Addison Wesley.

E-Learning Resources:

1. http://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.cs.unm.edu/~saia/classes/561-f21/

Course Outcomes:

CO1: Design and analyze programming problem statements.

CO2: Deploy sorting and search algorithms and analyze their computational complexities.

CO3: Implement standard operations on graph data structures

CO4: Analyse the time and space complexities.

CO5: To analyze Randomized, Distributed, Heuristics algorithms

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	H	H	-	-	M	M	L	L	H	M	L
CO2	H	H	H	H	-	-	-	M	L	L	H	M	L
CO3	L	H	H	H	-	-	-	M	L	L	H	M	L
CO4	L	H	H	H	-	-	-	M	L	L	H	M	L
CO5	L	H	H	H	-	-	-	M	L	L	H	M	L

Algorithms Laboratory

Semester III **Hours of Instruction / Week: 4**

23BCSC06P **No. of Credits: 2**

List of Programs:

1. Write a test program to implement Divide and Conquer Strategy . Eg: Quick sort algorithm for sorting list of integers in ascending order
2. Write a program to implement Merge sort algorithm for sorting a list of integers in ascending order.
3. Write program to implement the DFS algorithm for a graph.
4. Write program to implement the BFS algorithm for a graph
5. Write a program to implement the backtracking algorithm for the sum of subsets problem
6. Write program to implement greedy algorithm for job sequencing with deadlines.
7. Write a program to implement Dijkstra's algorithm for the Single source shortest path problem.
8. Write a program that implements Prim's algorithm to generate minimum cost spanning tree.
9. Write a program that implements Kruskal's algorithm to generate minimum cost spanning tree
10. Write program to implement Dynamic Programming algorithm for the 0/1 Knapsack problem.

Total hrs: 60

Course outcomes:

CO1: Analyze the time and space efficiency of the data structure

CO2: Organize and apply to solve the complex problems using advanced data structures

CO3: Propose nonlinear data structures trees and graphs and implement their operations.

CO4: Determine and Implement the appropriate data structure for a given problem

CO5: Develop practical knowledge on the applications of data structures

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	H	M	L	L	M	L	H	M	H	H	M
CO2	H	H	M	L	L	M	M	L	H	H	H	L	M
CO3	M	M	H	M	L	M	M	L	H	M	H	H	M
CO4	M	H	M	M	L	L	M	L	H	M	H	H	M
CO5	H	H	M	M	L	L	M	L	M	L	H	L	m

Computer Networks

Semester IV **Hours of Instruction/Week: 5+1**

23BCSC07 **No. of Credits: 6**

Objectives:

1. To understand the basic concepts of Computer Networks and data communication techniques.
2. To learn the layered architectures of network models and their functionalities
3. To know the applications of Computer Networks.

UNIT I: Introduction to Computer Networks and Data Communication Fundamentals **20 hrs**

Network Definition, Network Topologies, Network Classifications, Network Protocol, Layered Network Architecture, Overview of OSI Reference Model, Overview of TCP/IP Protocol Suite, Analog and Digital Signal, Data-Rate Limits, Digital to Digital Line Encoding Schemes, Pulse Code Modulation, Parallel and Serial Transmission, Digital to Analog Modulation - Multiplexing Techniques- FDM, TDM, Transmission Media.

UNIT II: Networks Switching Techniques **15 hrs**

Circuit Switching, Packet Switching- Connectionless Datagram Switching, Connection- Oriented Virtual Circuit Switching; Dial-Up Modems, Digital Subscriber Line, Cable TV for Data Transfer.

UNIT III: Data Link Layer Functions and Protocol **15 hrs**

Error Detection and Error Correction Techniques, Data-Link Control- Framing and Flow Control, Error Recovery Protocols-Stop and Wait ARQ, Go-Back-N ARQ, Point to Point Protocol on Internet.

UNIT IV: Multiple Access Protocol and Network Layer **20 hrs**

CSMA/CD Protocols, Ethernet LANS; Connecting LAN and Back-Bone Networks- Repeaters, Hubs, Switches, Bridges, Router and Gateways, Networks Layer Functions and Protocols, Routing, Routing Algorithms, Network Layer Protocol of Internet - IP Protocol, Internet Control Protocols.

UNIT V: Transport Layer and Application Layer Functions and Protocols **20 hrs**

Transport Services- Error and Flow Control, Connection Establishment and Release- Three Way Handshake, Overview of Application Layer Protocol. Overview of DNS Protocol; Overview of WWW & HTTP Protocol, NS2

Total Hours :90

Text Book

1. ***Behrouz A. Forouzan (2022), Data Communications and Networking****, McGraw Hill Education; sixth edition.*

Reference Book

1. ***Andrew S. Tanenbaum (2022), Computer Networks****, Pearson Prentice Hall; Sixth Edition.*
2. ***Stallings William (2017),*** *"Data and Computer Communication", Pearson Education; tenth Edition.*

E-learning Resources:

1. Computer networks, https://nptel.ac.in/courses/106106091

Course Outcomes:

CO1: Explain the reference models of networks and fundamentals of networks

CO2: Describe the switching mechanisms

CO3: Analyse the Data Link Layer functions and the protocols associated with it

CO4: Analyse the Multiple Access protocols and the functions of the network layer

CO5: Outline the Transport Layer and Application Layer Functions and Protocols

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	H	H	L	M	L	H	L	L	H	H	H
CO2	H	H	H	H	L	H	L	H	L	L	H	M	H
CO3	M	H	H	M	L	H	L	H	L	L	M	H	H
CO4	H	H	M	H	L	H	L	H	L	L	H	M	H
CO5	H	H	H	H	L	L	L	H	L	L	M	H	H

Software Engineering

Semester IV **Hours of Instruction / Week: 5+1 Hrs**

23BCSC08 **No. of Credits: 6**

Objectives:

1. To be familiar with the fundamentals of analysis and design of software systems.
2. Choose appropriate technology and methodology for software development.
3. To produce efficient, reliable, robust and cost-effective software solutions.

UNIT I: Introduction **18 hrs**

Software Development Approaches: Introduction; Evolving Role of Software; Software Characteristics; Software Applications. Software Design Processes: Introduction; Definitions of Software Engineering; The Linear Sequential Development Model; Iterative Development Model; The incremental Development Model

UNIT II: Software Design and Object -Oriented Design **18 hrs**

Software Design Principles: Introduction, System Models: Data-flow Models, Semantic Data Models, Object Models, Data Dictionaries; Software Design: The Design Process, Design Methods, Design description, Design Strategies, Design Quality; Architectural Design: System Structuring. An Object -Oriented Design Example, Object Aggregation; Service Usage; Object Interface Design

UNIT III: Assessment of Process Life-Cycle Models **18 hrs**

An Introduction; Overview of the Assessment of Process; The Dimension of Time; The Need for a Business Model in Software Engineering; Classic Invalid Assumptions: First Assumption: Internal or External Drivers, Second Assumption: Software or Business Processes, Third Assumption: Processes or Projects, Fourth Assumption: Process Centered or Architecture Centered; Implications of the New Business Model; Role of the Problem - Solving Process in this Approach: Data, Problem Definition, Tools and Capabilities; Redefining the Software Engineering Process: Round-Trip Problem-Solving Approach, Activities, Goals, Interdisciplinary Resources, Time.

UNIT IV: Software Metrics **18 hrs**

Software Reliability: Introduction; Software Reliability Metrics; Programming for Reliability: Fault Avoidance, Fault Tolerance, and Software Reuse.

UNIT V: Software Testing **18 hrs**

Software Testing Strategies: Introduction; Organizing for Software Testing; Software Testing Strategy, Unit Testing: Unit Test Considerations, Top-Down Integration, Bottom-Up Integration. Software Testing Techniques: Software Testing Fundamental; Testing Principles; White Box Testing; Control Structure Testing; Black Box Testing; Boundary Value Analysis, Case Tools

Total Hours: 90

Text Books:

1. R. G. Pressman (2016), Software Engineering - A practioners Approach TMH, *Seventh Edition.*

2. Somerville, Ian, Software Engineering, **Pearson Education, seventh edition.**

Reference Books:

1. Pankaj Jalote – An Integrated Approach to Software Engineering, Narosa Publications. Seventh Edition

2. Pfleeger, Shari Lawrence, Software Engineering Theory and Practice, second edition. Prentice- Hall 2001

3. Object Oriented & Classical Software Engineering (Fifth Edition), SCHACH, TMH

E-learning Resources:

1. nptel.ac.in/courses/106101061
2. tutorialspoint.com

Course Outcomes:

CO1: Acquire strong fundamental knowledge in software engineering.

CO2: Ability to design the software projects in objects oriented models.

CO3: Effectively demonstrate competence in Problem-Solving Approaches.

CO4: Adapt to new emerging technologies and methodologies.

CO5: Assuring software quality standards based on various testing strategies.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	L	M	M	H	M	L	M	H	M	M	L	L
CO2	M	L	M	M	H	M	M	M	M	M	M	M	M
CO3	L	H	H	H	H	H	H	M	M	M	H	L	M
CO4	L	H	H	H	H	H	H	M	M	M	M	H	H
CO5	L	M	L	M	M	H	H	M	L	M	L	M	M

Database Management Systems

Semester V **Hours of Instruction / Week: 4**

23BCSC09 **No. of Credits: 4**

Objectives:

1. To gain knowledge on Database management system, ER Diagrams, data modelling, normalization, transaction processing and concurrency control.
2. To be familiar on using SQL, Query Processing, database storage structures and access techniques.
3. To Compare, contrast and analyse the various emerging technologies for database systems such as NoSQL and applications of database technologies.

UNIT I **8 hrs**

Basic Database Concepts, Terminology, and Architecture; Types of Database Management Systems. Differences between Relational and other Database Models. Data Modelling: Relations, Schemas, Constraints, Queries, and Updates; Conceptual vs. Physical Modeling; Entity Types, attributes, ER Diagrams.

UNIT II **16 hrs**

SQL Data Definition: Specifying Tables, Data Types, Constraints; Simple SELECT, INSERT, UPDATE, DELETE Statements; Complex SELECT Queries, including Joins and Nested Queries; Actions and Triggers; Views; Altering Schemas. Relational Algebra: Definition of Algebra; Relations as Sets; Operations: SELECT, PROJECT, JOIN, etc. Normalization Theory and Functional Dependencies, 2NF, 3NF, BCNF, 4NF, 5NF

UNIT III **12 hrs**

Indexing: Files, Blocks, and Records, Hashing; RAID; Replication; Single-Level and Multi-Level Indexes; B-Trees and B+-Trees. Query Processing Translation of SQL into Query Plans; Basics of Transactions, Concurrency and Recovery.

UNIT IV **12 hrs**

DATABASE PROGRAMMING: Embedded SQL; Dynamic SQL, JDBC; Avoiding Injection Attacks; Stored Procedures; Lightweight Data Access Layers for Python and JavaScript Applications; PHP and MySQL, Object Relational Modeling: Hibernate for Java, Active Record for Rails.

UNIT V **12 hrs**

BIG DATA: Motivations; OLAP vs. OLTP; Batch Processing; MapReduce and Hadoop; Other Systems: HBase. Working with POSTGRES, REDIS, MONGO, and NEO: Setting up the same Database on Four Platforms; Basic Queries and Reporting.

Total Hours: 60 hrs

Text Books:

1. ***Ramez Elmasri, Shamkant B Navathe (2017), Fundamentals of Database Systems***, Addison-Wesley, Seventh Edition.

Reference Books:

1. ***Abraham Silberschatz, Henry. F. Korth, S. Sudarshan, (2013), Data base System Concepts,*** McGraw Hill Education, Sixth Edition.
2. ***Raghu Ramakrishnan, Johannes Gehrke, (2002), Data base Management Systems***, McGraw Hill Education, Third edition.

E-learning Resource:

1. www.tutorialspoint.com/dbms/
1. www.javatpoint.com/dbms-tutorial

Course Outcomes:

CO1: Obtain knowledge to model databases using ER diagram and creating schema.

CO2: Develop query processing skills and normalization of databases.

CO3: Acquire knowledge on Indexing and Concurrency Control.

CO4: Trained skill to solve problems in Database Programming.

CO5: Gain knowledge in Big Data concepts.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	L	M	-	-	-	H	H	-	-	L	H	-	-
CO2	M	M	-	M	-	M	M	L	-	-	H	L	L
CO3	M	-	-	-	-	H	H	M	M	-	H	H	M
CO4	-	-	M	M	-	M	M	-	-	-	H	H	L
CO5	-	-	L	-	-	M	H	L	-	-	H	H	L

Relational Database Management Systems Laboratory

Semester V **Hours of Instruction / Week: 4**

23BCSC09P **No. of Credits: 2**

List of Programs:

1. Design an E-R Model for a real-world problem.
2. Design a Relational Model for a real-world problem.
3. Programs using DDL Commands.
4. Programs using DML Commands.
5. Program using Relational Algebra Operations.
6. Design and normalize a relational database for a real-world problem.
7. Programs using PL/SQL commands.
8. Programs using Query Processing.
9. Programs using Embedded SQL.
10. Programs using Map Reduce and Hadoop

Total hrs: 60

Course Outcomes:

CO1: Design ER diagram and Relational Model using open source tools.

CO2: Develop query processing skills and normalization of databases.

CO3: Acquire knowledge on PL/SQL and Embedded SQL Programming.

CO4: Trained skill to solve problems in Database Programming.

CO5: Obtain skill in programming with Big Data.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	H	H	H	-	M	H	-	H	M	M	M	M
CO2	M	M	-	M	-	M	M	L	-	-	H	L	L
CO3	M	-	-	M	-	L	L	-	L	L	M	M	M
CO4	M	M	M	M	-	M	M	-	-	-	H	H	L
CO5	M	H	M	M	M	H	H	M	M	M	M	H	H

Internet Technologies

Semester V **Hours of Instruction / Week:5+1**
23BCSC10 **Number of Credits: 6**

Objectives:

1. To understand and analyse the interactions among those Internet technologies.
2. To describe the technologies that form the basis of the Internet and the methods of programming.
3. To develop the skills in writing program for different application based on scripting.

UNIT I: Introduction of Internet **18 Hrs**

Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web, Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Internet Routing Protocol: Routing - Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail: POP3, SMTP.

UNIT II: HTML and XML **18 Hrs**

HTML: Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps: map, area, attributes of image area. Extensible Markup Language (XML): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts: Introduction, Environment Variable, GET and POST Methods.

UNIT III: PERL **18 Hrs**

PERL: Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. JavaScript: Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object - string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies: Definit ion of cookies, Create and Store a cookie with example. Java Applets: Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.

UNIT IV: Client-Server programming In Java **18 Hrs**

Java Socket, Java RMI. Threats: Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques: Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall: Introduction, Packet filtering, Stateful, Application layer, Proxy.

UNIT V: Internet Telephony **18 Hrs**

Introduction, VoIP. Multimedia Applications: Multimedia over IP: RSVP, RTP, RTCP and RTSP.

Streaming media, Codec and Plugins, IPTV. Mywbut.com Search Engine and Web Crawler: Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.

Total Hours: 90

Text Books:

1. ***N.P. Gopalan and J. Akilandeswari, (2013), Web Technology: A Developer's Perspective,*** PHI,Learning, Delhi.

2. ***Rahul Banerjee, (2011), Internet working Technologies, An Engineering Perspective,*** PHI Learning, Delhi.

Reference Books:

1. ***Steven Holzner, 2009,"HTML Black Book"*** Dremtech press.

2. ***Craif Knuckles, David Yuen, (2006), "Web Applications : Concepts and Real World Design",*** Wiley-India.

3. ***Harvey M. Deitel, Paul J. Deitel, Tem R. Nieto, (2002), "Internet and World Wide :Web How to program",*** Prentice Hall.

4. ***Duckett, J.(2014). "JavaScript and JQuery: Interactive Front-End Web Development".*** Wiley

E-learning Resources:

1. https://www.vssut.ac.in/lecture_notes/lecture1423183400.pdf
2. https://www.gpcet.ac.in/wp-content/uploads/2018/02/unit-1.pdf

Course Outcomes:

CO1: Obtain the knowledge related to the Internet and how the Internet is changing the World.

CO2: Gain knowledge on how computers are connected to the Internet and demonstratethe ability to use the World Wide Web.

CO3: Demonstrate an understanding of and the ability to use electronic mail and other internet based services

CO4: Apply the design principles of Web pages and how they are created

CO5: Develop an ability to create basic Web pages with HTML.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	M	H	H	H	H	H	M	M	M	M	M	H	M
CO2	M	M	H	M	H	M	H	L	M	M	H	M	M
CO3	H	M	H	H	H	H	H	M	H	H	H	H	M
CO4	H	H	H	H	H	H	H	M	H	M	H	H	H
CO5	H	H	H	H	M	M	M	H	L	H	H	H	H

Professional Development Course

Technical Communication

Semester V **Hours of Instruction / Week: 2 Hrs**

23BCSPD3

Objectives:

1.Elucidate the various forms of communication.

2.Improve the capacity to communicate effectively through oral and writing skills.

3.Create and build expertise in various reporting styles.

Unit I: Fundamentals of Communication **6 Hrs**

Stages in communication- channels-nature of technical communication-types of communication skill-organization and style of technical communication.

Unit II: Professional Speaking **6 Hrs**

Job interviews- Characteristics- preparation techniques- questions and answering strategies, group discussions, presentation skills- oral presentation- planning, preparing and organizing the presentation.

Unit III: Writing Strategies **6 Hrs**

Writing effective sentences - structure, coherence and emphasis, using connectives, Paragraph writing-structure, principles -unity, coherence, developing a paragraph. Note making and summarizing techniques.

Unit IV: Professional Writing **6 Hrs**

Routine business letters- letter writing skills- form and structure - style and tone. Resume writing and Job application letters, business memos, writing for the Web.

Unit V: Reports **6 Hrs**

Reports- Types and formats- structure of formal reports, parts of a report-writing strategies. Proposals- nature and significance, types and structure of formal proposals. Technical articles- review and research articles- writing strategies. Investigative reports. Standard email practices and strategies.

Total Hours 30 hrs

Text Book:

1. M.Ashraf Rizvi,(2008), Effective Technical Communication, Tata Mcgraw Hill company.

2. ***Smith-Worthington and Sue Jefferson, (2017), Technical Writing for Success,*** Cengage Publishers, Fourth Edition.

Reference Books:

1. Krista Van Laan,(2013) The insider's guide to technical writing, XMLPress, First edition.

E-learning Resources:

1. https://libguides.sjsu.edu/techwriting
2. www.techprose.com/assets/techwriting_guidelines.pdf
3. http://www.ewh.ieee.org/soc/es/Aug1996/030/cd/write/begin.htm

Course Outcomes:

CO1: Improved grammatical structure and usage in communication.

CO2: Ability to choose between appropriate writing and communication styles.

CO3: Expertise in various reporting styles.

CO4: Effective presentation and writing skills.

CO5: Applying the learned skills in different areas of communication.

Artificial Intelligence

Semester VI **Hours of Instructions / Week: 5 + 1**

23BCSC11 **No. of Credits: 6**

Objectives:

1. To understand the fundamentals of Artificial Intelligence
2. To apply Artificial Intelligence methods in real world problem solving
3. To learn the concepts of Natural Language Processing and Learning techniques

Unit I: Introduction to Artificial Intelligence **18 Hrs**

Introduction to Artificial Intelligence – Problem Definition - Production Systems, Control strategies. Problem Characteristics - Production System Characteristics – Issues in Designing Search Programs – Problem Solving Methods: Heuristic Functions – Depth first and Breath first search, Generate–and–Test, Hill Climbing, Constraint Satisfaction – Problem Reduction - Constraint satisfaction – Related Algorithms, Performance Measures, Analysis of Search Algorithms.

Unit II: Knowledge Representation **18 Hrs**

Knowledge Representation: Approaches to Knowledge Representation – Issues in Knowledge Representation, Knowledge Representation using Predicate Logic: Representing Simple Facts in Logic – Representing Instance and ISA Relationships, Knowledge Representation using other Logic – Structured representation of knowledge.

Unit III: Statistical Reasoning **18 Hrs**

Statistical Reasoning : Probability and Bayes Theorem – Bayesian Network – Dempster – Shafer theory, Weak Slot and-Filler Structures: Semantic Nets - Frames, Strong Slot-and-Filler Structures: Conceptual dependency, Scripts – CYC.

Unit IV: Game Playing and Planning **18 Hrs**

Game Playing : The Minimax Search Procedure – Adding Alpha-Beta Cutoffs – Iterative Deepening, Planning : Components of Planning System – Goal Stack Planning – Nonlinear Planning – Hierarchical Planning – Other Planning Techniques.

Unit V: Natural Language Processing **18 Hrs**

Natural Language Processing: Introduction – Syntactic Processing – Semantic Analysis – Discourse and Pragmatic Processing – Statistical Natural Language Processing – Spell Checking, Learning: Introduction – Rote Learning – Learning in Problem Solving – Explanation based Learning - Formal Learning Theory.

Total Hours: 90

Text Books:

1. ***Kevin Night and Elaine Rich, Nair B., (2017), "Artificial Intelligence (SIE)"***, Third Edition, McGraw Hill.
2. ***Stuart Russel and Peter Norvig, (2010), "AI – A Modern Approach"***, Third Edition, Pearson Education.

Reference Books:

1. ***Dan W. Patterson, (2015), "Introduction to AI and ES"***, First Edition, Pearson Education.
2. ***Peter Jackson, (2007), "Introduction to Expert Systems"***, Third Edition, Pearson Education.
3. ***Deepak Khemani, (2017), "Artificial Intelligence"***, Tata McGraw Hill Education (Reprint).

E-Learning Resources:

1. https://www.britannica.com/technology/artificial-intelligence
2. https://www.ibm.com/topics/artificial-intelligence
3. https://www.udacity.com/course/intro-to-artificial-intelligence--cs271

Course Outcomes:

CO1: Acquire a comprehensive understanding of Artificial Intelligence

CO2: Get familiar with knowledge representations and its other logics

CO3: Explore the concepts of statistical reasoning

CO4: Get familiar with the concept of game playing and planning

CO5: Familiarize with Natural Language Processing and learning techniques.

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3
CO 1	L	H	M	H	H	M	M	M	H	H	H	M	M
CO 2	L	H	H	H	H	M	M	M	M	H	H	M	M
CO 3	M	H	H	H	H	M	M	M	M	H	H	H	H
CO 4	H	H	H	H	H	M	M	M	M	H	H	H	H
CO 5	H	H	M	H	M	M	M	M	M	M	H	M	M

Computer Graphics

Semester VI
23BCSC12

Hours of Instructions / Week: 4
No. of Credits: 4

Objectives:

1. To familiarize with the fundamentals concepts of computer graphics
2. To create interactive 2D and 3D transformations.
3. To understand the Virtual reality technologies.

Unit I: Introduction to Computer Graphics **12 Hrs**

Application Areas of Computer Graphics, Overview of Graphics Systems and Devices Points and Lines, Line Drawing Algorithms, Mid-Point Circle and Ellipse Algorithms. Filled Area Primitives, Polygon Filling Algorithms. Curve Generation: Bezier and B-SplineCurves.

Unit II: 2-D Geometrical Transforms and Clipping Algorithms **12 Hrs**

Translation, Scaling, Rotation, Reflection and Shear Transformations Composite Transforms, Transformations between Coordinate Systems. 2-DViewing: The Viewing Pipeline, Viewing Coordinate Reference Frame, Window to Viewport Coordinate Transformation, Viewing Functions. Line Clipping Algorithms- Cohen- Sutherland and CyrusBeckLine Clipping Algorithms, Sutherland–Hodgeman Polygon Clipping Algorithm.

Unit III: 3-D Geometric Transformations **12 Hrs**

Translation, Rotation, Scaling, Reflection and Shear Transformations, Composite Transformations, 3-D Viewing: Viewing Pipeline, Viewing Coordinates, View Volume, General Projection Transforms and Clipping.

Unit IV: Visible Surface Detection Methods **12 Hrs**

Classification, Back - Face Detection, Depth-Buffer, Scanline, Depth Sorting, BSP-Tree Methods, Area Sub-Division and Octree Methods , llumination Models and Surface Rendering Methods: Basic Illumination Models, Polygon Rendering Methods-Computer Animation: Design of Animation Sequence, General Computer Animation Functions KeyFrame Animation, Animation Sequence, Motion Control Methods, Morphing.

Unit V: Virtual Reality **12 Hrs**

Basic Concepts, Classical Components of VR System, Types of VR Systems, Three Dimensional Position Trackers, Navigation and Manipulation Interfaces, Gesture Interfaces. Input Devices, Graphical Rendering Pipeline, Haptic Rendering Pipeline, OpenGL Rendering Pipeline. Applications of Virtual

Reality.

Total Hours: 60

Text Books:

1. ***Donald Hearn and M.Pauline Baker, (2014) "Computer Graphics with OpenGL"***, 4th Edition, Prentice Hall.
2. ***Rakesh. K Maurya,(2013) "Computer Graphics with Virtual Reality"***, 3rd Edition, Wiley

Reference Books:

1. ***Foley, Van Dam, Feinerand Hughes, (2003), "Computer Graphics Principles & practice"*** , 3rd edition, Pearson Education.

E-learning Resources:

1. *https://ocw.mit.edu/courses/6-837-computer-graphics-fall-2012/6f428ed2118ba83b38ad09c9c788b7b9_MIT6_837F12_Lec00.pdf*
2. *https://www.tutorialspoint.com/computer_graphics/index.htm*

Course Outcomes:

CO1: Acquire knowledge of fundamental algorithms used in computer graphics.

CO2: Design and implement various graphical primitives techniques.

CO3: Develop interactive computer graphics systems.

CO4: Application of the modern tools to develop multimedia skills

CO5: Create simple applications using virtual reality.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	H	H	-	M	L	L	M	L	H	M	M
CO2	H	M	H	H	-	M	M	L	H	L	H	M	M
CO3	H	L	M	H	-	M	L	L	H	L	H	-	M
CO4	M	M	M	H	-	M	M	L	M	L	L	-	M
CO5	M	M	M	M	-	L	L	L	M	L	L	-	M

Computer Graphics Laboratory

Semester VI **Hours of Instruction / Week: 4**

23BCSC12P **No. of Credits: 2**

List of Programs:

1. Write a program to draw line using Line Drawing Algorithms.
2. Write a program to draw Circle using Midpoint Algorithm
3. Write a program to clip the lines using line clipping algorithms.
4. Write a program for 2D Transformations like Translations, Scaling and Rotations.
5. Write a program to Ellipse Drawing Using Midpoint Algorithm
6. Create a layer animation using GIMP.
7. Apply the filter effect in image using GIMP.
8. Create a web index page using GIMP.
9. Create a logo design by GIMP.
10. Create natural scenery using 2D PENCIL.
11. Create a glossy button using 2D PENCIL
12. Apply the filter effect in image or font using 2D PENCIL.
13. Create a Text animation using 2D PENCIL.
14. Create a movie clip animation using 2D PENCIL.
15. Create a symbol and guide layer using 2D PENCIL

Total Hours: 60

Course Outcomes:

CO1: Implement the concepts of algorithms to construct basic shapes

CO2: Realize the concepts of Multimedia Systems and apply editing tools for images.

CO3: Design and implement an animation for various themes.

CO4: Create a multimedia advertisement.

CO5: Compose audio with effects.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	H	H	M	H	M	L	M	H	M	M	H
CO2	H	H	H	H	H	H	H	L	H	H	H	H	H
CO3	H	H	H	H	H	H	H	L	H	H	H	H	H
CO4	H	H	H	H	H	H	H	L	H	H	H	H	H
CO5	H	H	H	H	H	H	H	L	H	H	H	H	H

Professional Development Course

Professional IT Skills

Semester VI **Hours of Instruction / Week: 2 Hrs**

23BCSPD4

Objectives:

1.To enable students to foster creative thinking for professional communication and personality development.

2.To use the modern Information and Communication Technology for effective communication. .

3.To exhibit the highest performance of professionalism and integrity.

Unit I: General Topics **6 Hrs**

Conversation - Categories, process, limits, requirements, respond in a conversation, conversational strategies. **Greetings** - formal, informal, closing, interrupting, requesting permission expressions, inviting, refusing, recognizing a set of oral instructions. **Speaking skills** - dialogue in different social situations, making appointment, requisition.

Unit II: Corporate Culture **6 Hrs**

Attitude, Self-Motivation, Emotional Intelligence Quotient, e-mail etiquettes, telephone conversation. **Interview** - Meaning, preparing for and facing interview. **Debate. Extempore. Assessment and development of personality.**

Unit III: Personal **6 Hrs**

Self-esteem, Self- confidence, Happiness, positive thinking , ascertainment , emotional maturity , Weakness, fear, anxiety, anger, worry, permission. **Goal setting. Decision making and problem solving.**

Unit IV: International Relationships **6 Hrs**

Transaction analysis, stress management. **Health** - hazards and how to cope up with that. **Entrepreneurship** – Need, Scope and characteristics, special schemes for technical entrepreneurs, entrepreneurship and techniques. **Creativity and innovation.** Problem solving approach, strengths, weakness, opportunity and threat technique.

Unit V: Elements of Marketing **6 Hrs**

Concept, planning, product development, printing and promotion mix methods. **Publicity Vs Advertisements,** public relations, dress relations. **Reporting,letter, mixtures, agenda, notice, questionnaire, resume, proof, sending, editing text, speeches, telegrams, fax messages.**

Total Hours 30 hrs

Text Book:

1. ***Stella.Cottell (2010). Skills for Success,*** Second Edition, Palgrave Macmillan.

Reference Books:

1.P.Subha rao, M.Sundaram (2000). Entrepreneur Enterprises and growth options, First Edition , Kanishka Publishers, New Delhi.

2.V.S.Ramaswamy, S.Namakumari (2009). Marketing management, Forth Edition, Macmillan Publishing India Ltd.

E Learning Resources:

1. https://www.englishclub.com/speaking/guide.php
2. https://www.investopedia.com/terms/c/corporate-culture.asp
3. https://www.helpguide.org/articles/stress/stress-management.htm

Course Outcomes:

CO1: Effectively communicate through verbal/oral communication and improve the listening skills.

CO2: Actively participate in group discussion / meetings / interviews and prepare & deliver presentations

CO3: Become more effective individual through goal/target setting, self-motivation and practicing creative thinking.

CO4: Function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality.

CO5: Gain intellectual Competency and an edge through Professional Competency